ENGINEERING AND MINING JOURNAL

A McGRAW HILL PUBLICATION

JUNE 1957

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FOUNDED 1866

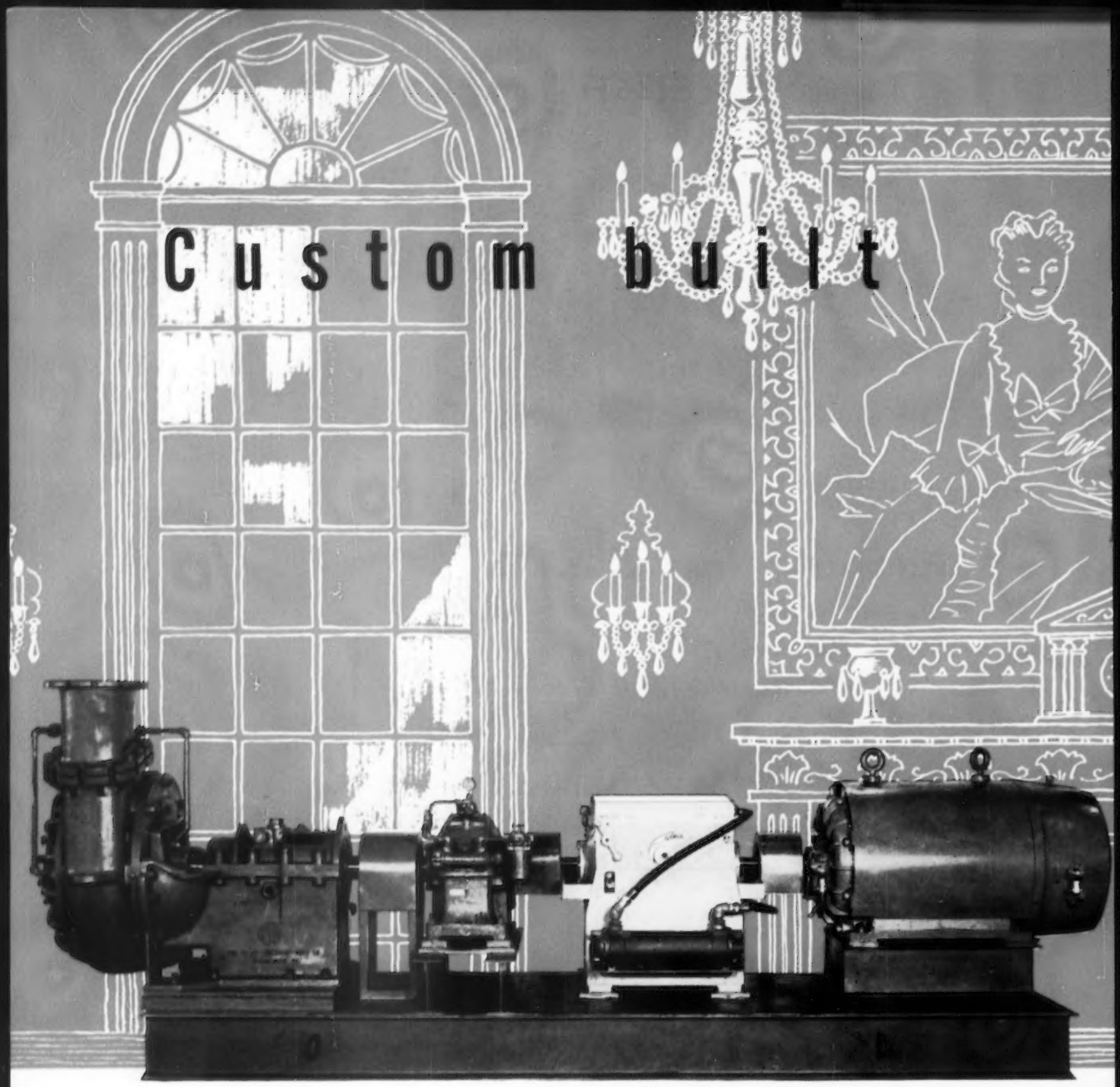
Manitoba — At Flin Flon, Hudson Bay Mining & Smelting Co. Ltd. fumes reverberatory slag, running 8% Zn, recovering 87% of the contained metal at the rate of 30,000 tons of zinc-in-fume per year. p 82

Narvik, Norway — Vastly increased tonnages of Swedish iron ore are stockpiled, mixed and sorted at an ultra-modern port. p 92

Minnesota — Drilling and blasting symposium adds to increased knowledge of what actually goes on at the bottom of a drill hole. p 97

New Brunswick — C. P. Jenney discusses exploration and geology in the Bathurst-Newcastle area where a major lead-zinc-silver mining camp is being developed. p 95

New York State — An AEC contract to purchase uranium concentrates is the prize won by an operator only 60 miles from New York City. p 81



This completely engineered pumping unit is a 12″ Hydroseal pump, direct-connected through a gear-reduction unit to a variable-speed fluid drive powered by a constant-speed motor. Installed in duplicate along with a large number of other Hydroseal pumps in a new Southeastern glass plant, it is a fine example of A-S-H special engineering. If you pump abrasives or corrosives, write us about it.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
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HYDROSEAL *and* **CENTRISEAL**
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

LIGHTER IN WEIGHT . . . EASIER ON AIR

75-LB STOPEHAMER

saves time, effort and air on all up-hole drilling jobs

R-38A

. . . designed to take full advantage of longer-lasting, faster-drilling CARSET JACKBITS

The exceptionally light-weight and well-balanced design of the Ingersoll-Rand R-38A Stopehamer pays off in increased production. It not only weighs up to *26% less* than older-type stopers, but also uses *25% less compressed air.*

Built to stay underground this powerful, light-weight drill has automatic rotation, self-cleaning chuck, graduated throttle for easy collaring and protected exhaust ports. Ask your I-R representative for complete information on the cost-cutting R-38 Stopehamer.

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ENGINEERING AND MINING JOURNAL

91st YEAR OF PUBLICATION

JUNE 1957

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World News Bureaus: London, Bonn, Paris, Rio de Janeiro, Mexico City, Beirut, Tokyo, Melbourne. **World News Offices:** Stockholm, Manila, Buenos Aires, Caracas, Havana, Lima, Santiago, Montreal, Toronto, Vancouver, Johannesburg.

Published monthly with an additional issue in Mid-June by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), founder. Publication Office: 1309 Noble St., Philadelphia 23, Pa. See panel below for directions regarding subscription or change of address.

Executive, Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Donald C. McGraw, president; Joseph A. Gerardi, executive vice president and treasurer; John J. Cooke, secretary; Nelson Bond, executive vice president, publications division; Ralph B. Smith, vice president and editorial director; Joseph H. Allen, vice president and director of advertising sales; A. R. Venezian, vice president and circulation coordinator.

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Subscription rates for individuals in the field of the publication: United States and possessions $4 a year; $6 for two years; single copy $1. Canada $5 a year; $8 for two years; single copy $1. Other Western Hemisphere and Philippines $8 a year; $12 for two years; $16 for three years; single copy $1.50. Elsewhere $15 a year; $25 for two years; $30 for three years; single copy $2.

Entered as second class mater May 24, 1951 at the Post Office at Philadelphia, Pa., under the Act of March 3, 1879. Title registered in the U. S. Patent Office

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SUBSCRIPTIONS: Send subscription correspondence and change of address to Subscription Manager, ENGINEERING & MINING JOURNAL, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose and address label from a recent issue of the magazine. Please allow one month for change to become effective.

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B.F.Goodrich report:

One belt does the work of 3 on high lift, long distance hauls

Oldest steel cord belt on Iron Range now in its 10th season

Problem: It's over a third of a mile and a 340-foot lift from the bottom of that iron ore mine up to railroad cars. Getting ore out of a deep pit like this used to take a series of three or more conveyor belts. No one belt could be strong enough for the job without being so heavy and stiff it would be impractical.

What was done: B.F.Goodrich engineers went to work on the problem, and developed steel cord construction. In this exclusive conveyor belt design, individual steel cords run lengthwise, each completely surrounded by rubber. These parallel cords give tremendous strength, yet are flexible so that troughing is natural, belt keeps centered on idlers, spillage is held to a minimum.

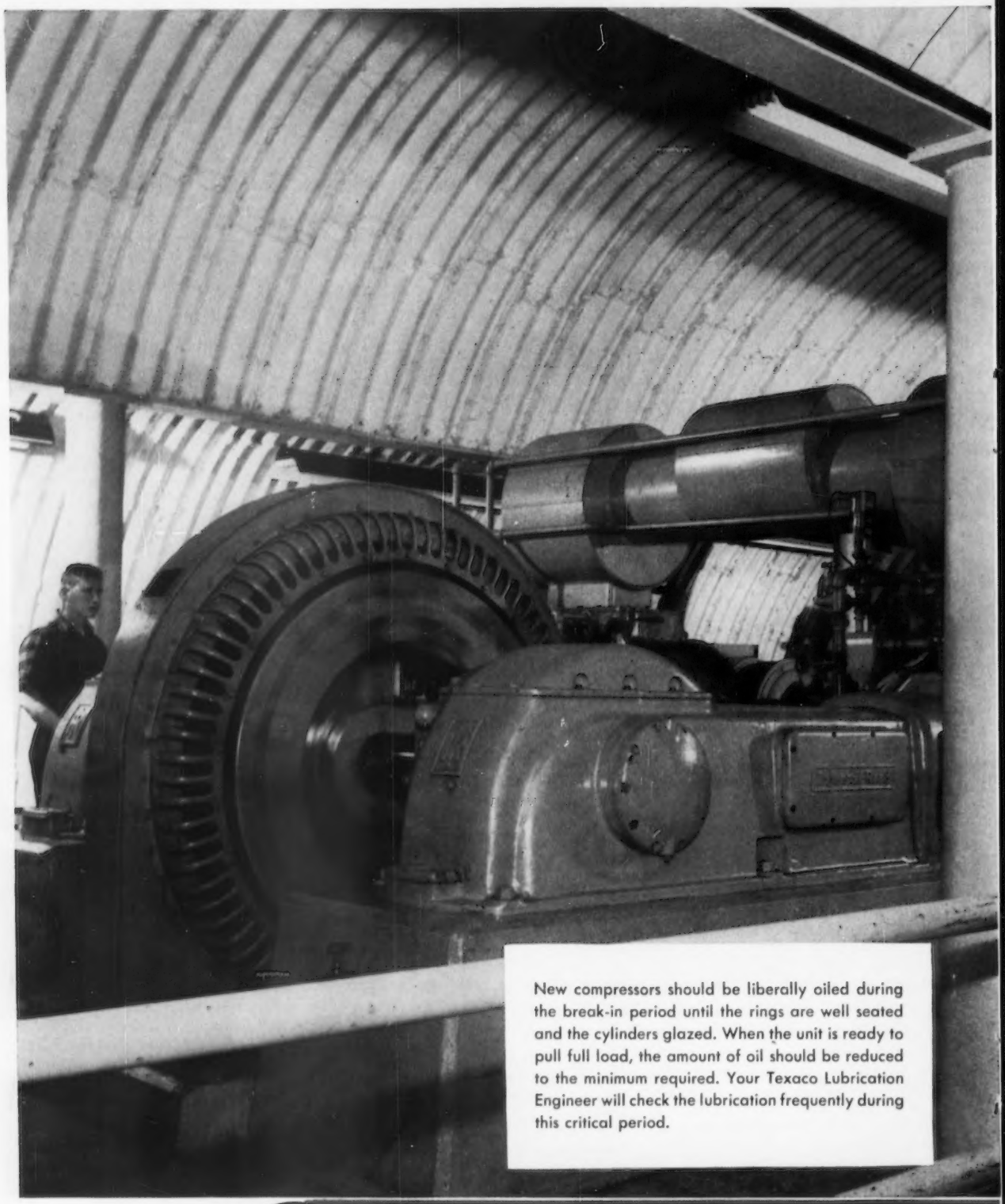
Savings: With steel cord construction, one conveyor belt now does the job of three or four belts on high lift, long distance installations. Money is saved, maintenance reduced, because the steel cord belt eliminates the transfer points necessary with a conveyor system built in several stages with ordinary belts.

Extra benefits: The B.F.Goodrich steel cord belt installed here has been at work 10 seasons now, hauling 1000 tons of ore an hour up and out of the pit. It has lasted longer than any conveyor belt ever made with steel cords or cables.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-981, Akron 18, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS



New compressors should be liberally oiled during the break-in period until the rings are well seated and the cylinders glazed. When the unit is ready to pull full load, the amount of oil should be reduced to the minimum required. Your Texaco Lubrication Engineer will check the lubrication frequently during this critical period.

TEXACO

Do signs of wear mean a compressor needs more oil?

Some operators think the answer is "yes" and increase the amount of oil fed to the cylinders when they see signs of wear. The result is that they often over-lubricate, causing excessive carbonization. This popular misconception is one of the biggest problems in air compressor lubrication.

The fact is, wear usually results from contaminants such as rust particles, pipe scale and condensation.

For full protection from these contaminants, use *Texaco Regal Oils R&O*. They have additives that combat rust and oxidation effectively. Extra processing at Texaco refineries removes the impurities that form gum, sludge and carbon. And there is a complete line of *Texaco Regal Oils R&O* —including one that is right for each compressor regardless of type, size, operating conditions and pressure.

TEXACO ROCK DRILL LUBRICANT EP gives your drills extra protection against wear—prevents rust whether the drills are working or lying idle.

FOR MORE THAN TWENTY-FIVE YEARS MORE COPPER ORE IN THE UNITED STATES HAS BEEN MINED WITH TEXACO LUBRICATED EQUIPMENT THAN WITH ANY OTHER

Get the benefits of your Texaco Lubrication Engineer's experience when you choose lubricants for your compressor. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels
FOR THE MINING INDUSTRY

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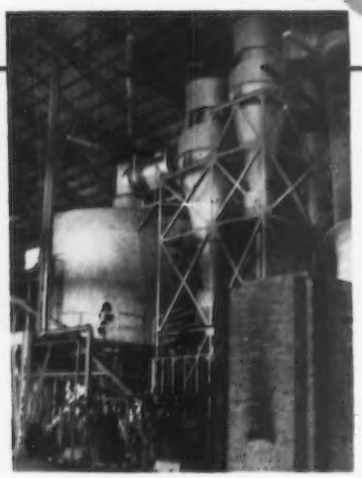
"Everything From a

H_2SO_4 Cu



One of two 20 ft. dia. FluoSolids Reactors roasting 235 metric tons per day of crushed pyrrhotite ore at Dowa's Okayama Plant.

Fluidization—

key to maximum utilization in Japan

Processing copper bearing pyrrhotite ore, the Dowa Mining Company at the Okayama, Japan plant is producing . . . and all from the same raw material . . . sintered iron ore for blast furnace use, cement copper and sulphuric acid.

Of major importance in this unique installation is the Dorrco FluoSolids System, consisting of two 20 ft. dia. Reactors plus auxiliary equipment. Utilizing the proven principles of fluidization, the crushed raw ore is roasted under controlled conditions in the System providing SO_2 gas for contact acid manufacture. Roaster calcine is acid leached for copper recovery and leach residue is sintered as blast furnace feed.

The Dorr-Oliver research, design and engineering staffs and our Associates in Japan, Sanki Engineering Co. Ltd., of Tokyo, have collaborated with Dowa Engineers before. At Dowa's hydro-metallurgical plant in Kosaka, Japan, the Dorrco FluoSolids System is a prime factor in the world's first successful roasting of copper and zinc with electro winning of both metals. In the Okayama installation as at Kosaka, manufacture of the FluoSolids Reactors and a number of components in Japan with auxiliary equipment furnished from the U. S. proved to be most advantageous to Dowa.

This is but another example of how the flexibility of the Dorr-Oliver Worldwide engineering organization can work to the advantage of a client. It can work for you . . . For detailed information on D-O equipment and services involving the separation of finely divided solids in suspension or fluid techniques, drop a line to Dorr-Oliver Inc., Stamford, Connecticut.

Dorrco and FluoSolids are Trademarks of Dorr-Oliver Inc., Reg. U. S. Pat. Off.

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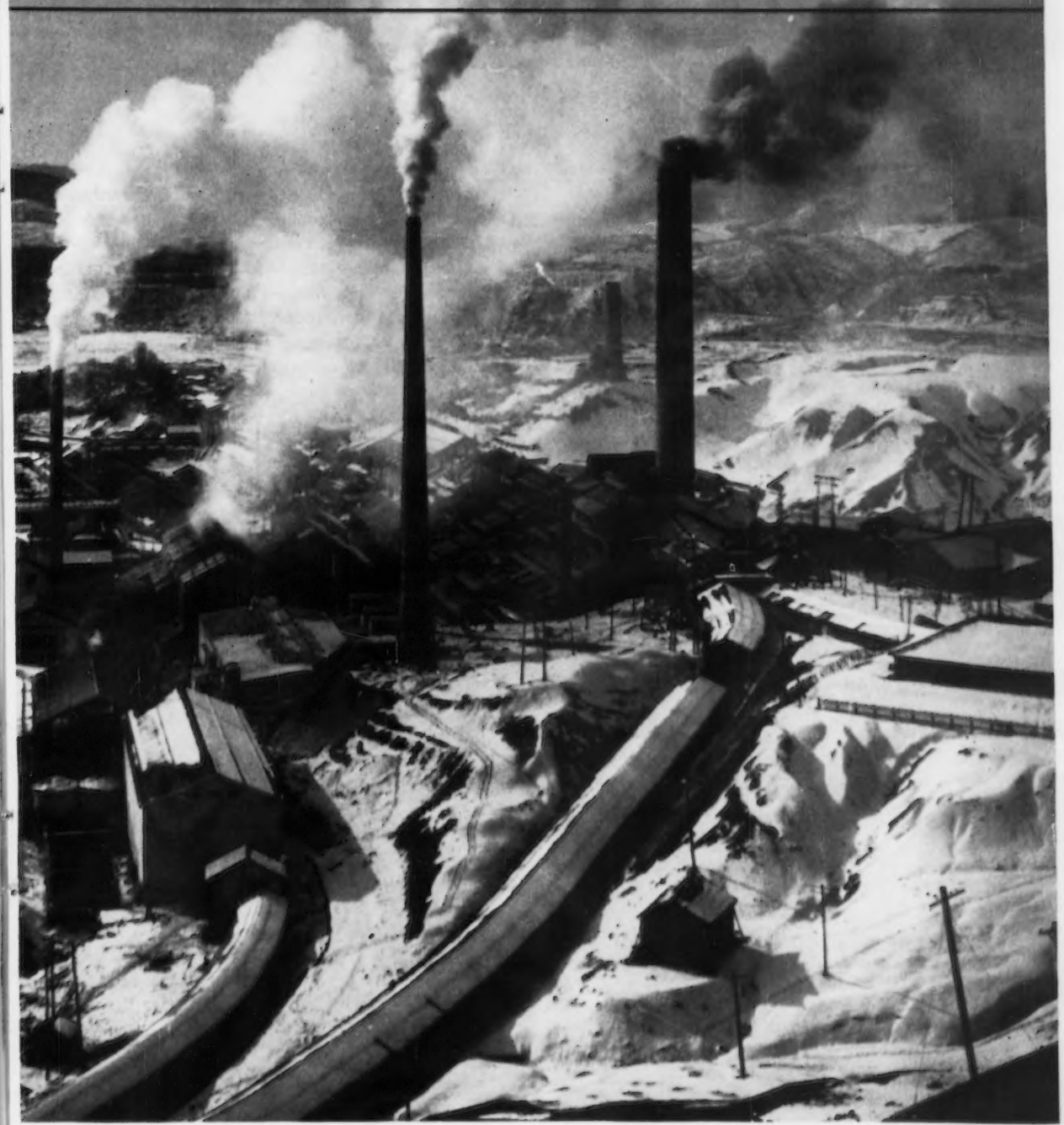
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

Dowa Mining's Kosaka hydro-metallurgical plant where Dorrco FluoSolids System roasts 83 metric tons of complex copper-zinc concentrates per day.

But the Squeal" Single Source . . .



ONLY YOUR International distributor *can make this deal:*

Four-for

Buy your job-sized 4-In-1 on tracks or rubber from a complete line of profit-producing rigs.

Now—why tie-up useful money or "strap" your credit by "over-equipping"? Why spend upwards of four times as much for several limited-duty machines which one 4-In-1 can replace—and outproduce?

An International Drott 4-In-1 gives you 4-machine usefulness for one moderate investment. Yes, the exclusive and revolutionary 4-In-1 gives you instant availability of 4 big-capacity machine actions!

You get world-beating Skid-Shovel excavating-

All-in-1 International Drott 4-In-1

"Carry-type scraper"

with "see-easiness" of front-mounting—to grade, strip, spread, or compact with amazing, inch-close accuracy!

Skid-Shovel...

with Drott's exclusive, "concrete-smashing," triple-power pry-action break-out—and 42" ground-level bucket roll-back!

machine job-capacity One-machine price!

loading performance. You get exclusive multi-purpose "carry-type scraper" action. You get production-boosting clamshell action. You get "radius-controlled" bulldozer action with big-yardage earth-rolling ability!

You get 4-In-1 versatility unlimited for a fraction of the price of the machines it can replace and outperform, on job after profitable job!

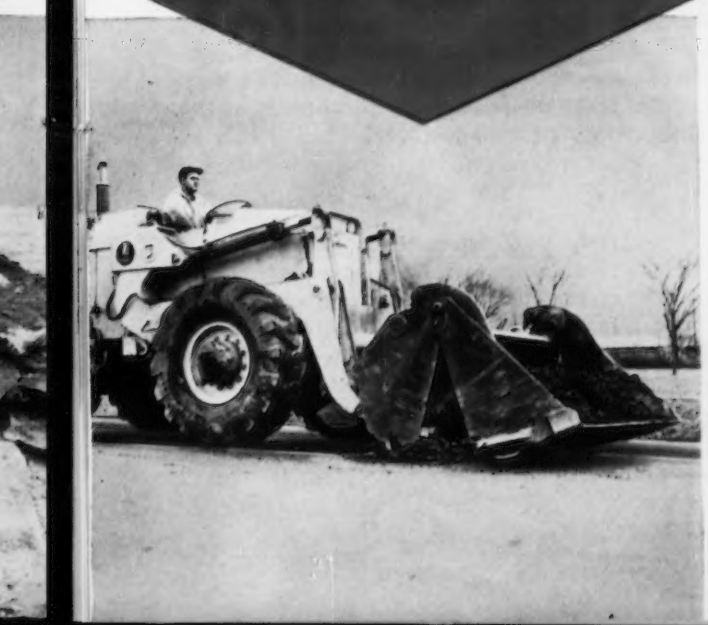
And you can have 4-In-1 advantages teamed with all-condition International crawler traction, or rubber-tired Hough Payloader speed!

See your International Distributor—he's the only one who can offer you a 4-In-1 deal! He's the only one who can save you the thousands of dollars that 4-In-1 ownership assures—by giving 4-machine utility for one moderate investment. And he can prove the "heap of difference" in 4-In-1 performance on tracks or rubber—against anything else in the field! See him soon for a demonstration!

gives you...

Clamshell...

that "surrounds" loose materials and fills in one fast gulp—gives you "hopper-high," self-cleanout dumping action.



Bulldozer...

with clam lip up, and skid shoes on the ground, the radius-controlled blade rolls the earth with precision!

ONLY YOUR International distributor CAN OFFER THESE EXCLUSIVE FEATURES!

Here's job-range..

Exclusive triple-power pry-action break-out

Inbuilt ability to deliver tremendous excavating force enables this TD-9 4-In-1 to yank out deeply embedded old masonry piers. You see typical, on-the-job advantages of true and exclusive International Drott pry-over-shoe break-out action—the only design that gives you the three absolute essentials: (1) Full hydraulic power transfer from full piston-face power-push; (2) Long lever to apply full pry-power; (3) Fixed fulcrum of frame-mounted skid-shoes, to concentrate pry-force!

Exclusive parallelogram raise action

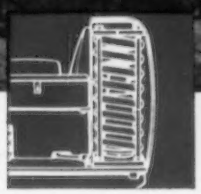
No eccentric tipping to cause spill-back and lose yardage! The 4-In-1 has non-spill, roll-back level—all the way up. Compared to ordinary front-end loader performance, this feature, alone, can increase your daily yardage up to 18%! You can bottom-dump the 4-In-1 as a clamshell...and do it 2½-foot higher than ordinary roll-forward buckets. And bottom dumping eliminates the sticky materials problem—where other rigs foul up and can't get the job done!

Check these other famous International Drott Exclusives!

- **STANDARD EQUIPMENT.** Three-valve design, to provide hydraulic control power for attachments.
- **STANDARD EQUIPMENT.** Double-bottom, bridge-truss bucket to insure 4-In-1 strength to match pry-action.
- **STANDARD EQUIPMENT.** Yoke-type supports to insure linkage strength to back 4-In-1 capacity!
- **STANDARD EQUIPMENT.** Magnetized dip stick to prevent damage to hydraulic system from minute abrasives!

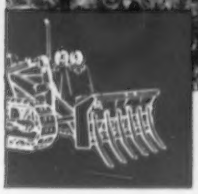
Only your International Distributor can offer you the big money-making advantages of International Drott exclusive 4-In-1 features. Only he can deliver you job versatility unlimited, in the world's only multi-purpose machine of its type! Prove to yourself that your correct size of 4-In-1 can replace and outperform a whole machinery yard full of limited-duty rigs. Ask for a demonstration!

where 4-in-1 gets world-beating ... capacity... stay-put performance!



Exclusive shock-swallowing Hydro-Spring

Capacity-boosting, machine-protecting Hydro-Spring is a hydraulic cylinder enclosed in a heavy-duty locomotive-type coil spring. Shock force displaces oil from main lift cylinders into the Hydro-Spring cylinder—extending it and compressing the big spring to absorb and cushion impact loads. Slamming the 4-In-1 bucket into hard material—'dozing frozen ground—dumping rock with a bang—you never worry! Hydro-Spring gentles trouble-causing forces by two-thirds or more—practically eliminates hydraulic hose failures!



Complete line of attachments

Job-getting, money-making attachments built for specialized duty, provide tree-grubbing, boulder-bucking, log-loading performance available only from International Drott equipment! Grubber Blade attachment, used in place of the 4-In-1, is shown applying the tremendous force of pry-action break-out—to uproot a tough old oak tree. Other special attachments built to extend International Drott advantages to other fields include: Rock Forks, Skid-Grapples®, Bulldozer and Bullangledozer blades!

CHOOSE FROM

four 4-in-1 sizes

TRACTOR SIZE	4-IN-1 CAPACITY
TD-6	1-YARD
TD-9	1½-YARD
TD-14	2¼-YARD
TD-18	3-YARD

International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.
Drott Manufacturing Corp., 3126 South 27th St., Milwaukee 15, Wis.

INTERNATIONAL HARVESTER

INTERNATIONAL® DROTT®

ONLY

your International distributor can give you 4-in-1 Performance *ON RUBBER!*

NO-STOP POWER SHIFT

One lever makes all shifts forward and reverse under full throttle — no clutching, no stopping. Torque converter provides infinite speed ratios.

PAYLOADER® mobility

PLUS four-machine utility

The only rubber-tired tractor-shovels available with Drott 4-in-1 buckets

Now you get even more tractor-shovel performance when you buy a "PAYLOADER". Equipped with a Drott 4-in-1 bucket, your "PAYLOADER" can handle many jobs that other wheeled tractor-shovels can't touch . . . perform shovel, clamshell, scraper or bulldozer work that would otherwise require several separate machines.

With a Drott 4-in-1 on a "PAYLOADER" you also get:

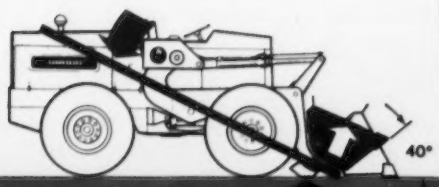
MOBILITY — quick-to-job travel over streets or highways under its own power . . . ability to work on or off paved surfaces.

MANEUVERABILITY — easy operation and fast loading cycles because of responsive rear-wheel power steering, "no-stop" finger-tip power shifting, dependable 4-wheel power brakes.

BALANCE AND STABILITY — long wheelbase . . . hydraulic load-shock-absorber . . . low, close bucket-carry position, all contribute to the easier riding qualities, the higher carrying speeds and the unusual balance that are outstanding "PAYLOADER" operating advantages.

TRACTION AND DIGGING POWER — exclusive power-transfer differentials, planetary final drives and the powerful pry-out bucket digging action help these "PAYLOADER" units to outperform other tractor-shovels of comparable size. Your International Distributor is anxious to demonstrate what these "PAYLOADER" tractor-shovels with a Drott 4-in-1 bucket can do for you. Ask him about the "PAYLOADER" Deferred Payment Plan.

PRY-OUT DIGGING ACTION

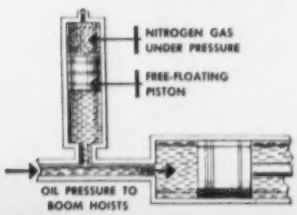


Exclusive "PAYLOADER" bucket action combines a powerful prying force over "break-out" pads, with 40° bucket tip-back *at ground level* to get heaped loads into bucket quickly and easily.

POWER-TRANSFER DIFFERENTIALS

These special differentials give better traction under all conditions — automatically deliver 25% more power to the wheels with the better traction.

LOAD SHOCK ABSORBER



This important device is a part of the hydraulic system. It cushions the loaded bucket, smooths the ride, permits faster carrying speeds, reduces spillage, boosts production.

All three sizes of 4-wheel-drive "PAYLOADER" tractor-shovels, models HU, HH and HO, are available with Drott 4-in-1 buckets, sizes 1, 1½ and 2¼ cu. yd. respectively.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
726 Sunnyside Ave., Libertyville, Ill.

Send full data on 4-wheel-drive "PAYLOADER" model ( ) with Drott 4-in-1 bucket to:

Name
Title
Company
Street
City State

90

PEAK CAPACITY

with

KENNEDY EQUIPMENT

NEW BRAUNFELS, TEXAS,
LIME PLANT
UNITED STATES GYPSUM
COMPANY

General View of Plant Showing KVS 10′ x 150′ Kiln with Preheater Internal Recuperator and Preheater

KENNEDY PRODUCTS

- Gyratory Crushers
- Swing Jaw Crushers
- Tube Mills
- Ball & Rod Mills
- Vibrating Screens
- Rock Feeders
- Air Swept Tube Mills
- Rotary Kilns
- Coolers, Dryers
- Preheaters, Deheaters
- Belts, Conveyors
- Pneumatic Transport Systems
- Asbestos Plants
- Complete Lime Plants
- Complete Cement Plants
- Steam Generators
- Complete Aggregate Processing Plants
- Waste Heat Boilers
- Pulverized Coal Firing Systems

Send for bulletin describing KVS Machinery and Equipment

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MANUFACTURING & ENGINEERING CORPORATION

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OF LIME PER DAY

...for New Braunfels, Texas plant of United States Gypsum Company

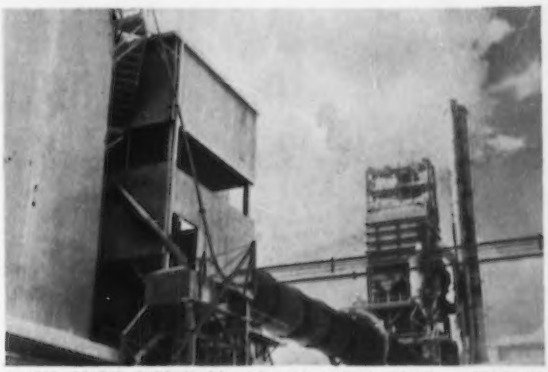
LIME PLANT PRODUCTION BEYOND RATED CAPACITY

One of America's largest lime producers, United States Gypsum Company chose KVS design and equipment for their new plant at New Braunfels, Texas.

Machinery and equipment designed and furnished by KVS includes crushers, screens, conveyors, kilns, preheaters, deheaters. The installation also provides the latest automatic controls and special equipment that permits high temperature "aging lime" — important in achieving highest quality. Also, storage capacity at this plant has been almost tripled.

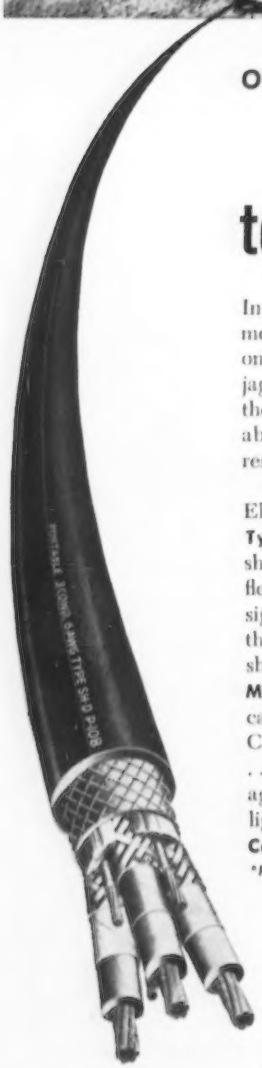
Whether your plant is large or small, old or new, Kennedy has the machinery and equipment for better products at lower cost. Let us prove . . . with operating facts . . . why KVS machinery is your best buy. Engineering consultation, anywhere, any time.

UNITED STATES GYPSUM CO., NEW BRAUNFELS, TEXAS — STONE PREPARATION PLANT COMPRISING KENNEDY 37½ S GEARLESS CRUSHER, KENNEDY AAA VIBRATING SCREEN AND KENNEDY BELT CONVEYORS



UNITED STATES GYPSUM CO., NEW BRAUNFELS, TEXAS — CLOSE-UP VIEW SHOWING INSTALLATION DETAILS OF KVS 10′ x 150′ ROTARY KILN, PREHEATER, RECUPERATOR AND DEHEATER

UNITED STATES GYPSUM CO., NEW BRAUNFELS, TEXAS — OVERALL VIEW OF STOCKPILE SHOWING OPERATION AND ARRANGEMENT OF CONVEYORS



ON ANY MINE ELECTRICAL DISTRIBUTION SYSTEM YOU PLAN . . .

There's a General Electric cable to give the best-possible performance

In selecting a cable that best suits your requirements, it is important, of course, that you choose one that can withstand being dragged over jagged rocks and through water. In addition, the cable must be tough, flexible, resilient and abrasion-, sunlight-, oil-, acid-, and alkali-resistant.

Here are a few examples from General Electric's complete line:

Type SH-D—For use primarily with electric shovels, where a cable must be exceptionally flexible, resilient, and abrasion-resistant. Designed for maximum protection to personnel by the use of ground wires and individual flexible shields on the individual conductors.

Mine Power Cable—A nonmetallic-sheathed cable for primary distribution to load centers. Can be buried directly or installed in the open . . . insulation is resistant to ozone, heat and aging . . . non-metallic construction makes it light weight and easy to install.

CordX*—A heavy-duty, flexible cord suited to portable electrical equipment which encounters severe usage and where exceptional mechanical, moisture, heat, and chemical resistance is required. Has U. S. Bureau of Mines approval.

Interlocked Armor Cable System—For distribution systems in preparation plants and other similar applications. Provides for system expansion or relocation in the future without major modifications. Available with either varnished-cambric, rubber, thermoplastic, or asbestos insulation for power or control cables.

Mining Machine Cables, Types W and G—Designed for especially severe conditions, such as being dragged behind mining machines, hit by picks, run over by equipment. Is exceptionally flexible, resilient, and abrasion-resistant.

FOR FULL INFORMATION on how G-E cable can help you, write for complete data on the G-E line of wire and cable. Just address Section W215-695, Wire and Cable Department, General Electric Company, Bridgeport 2, Conn.

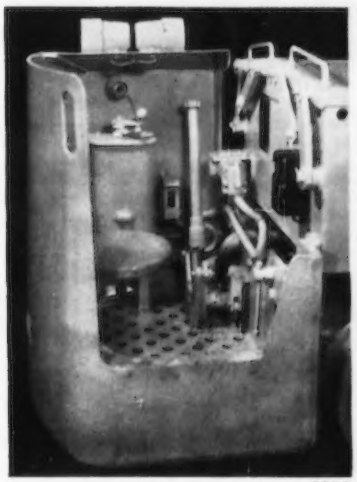
*Registered Trade-mark General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

2298

It's safety first all the way with Mancha's Storage Battery Locomotves



2299

Cab is roomy with shoulder high, heavy guard plate. All welded construction provides rigid, reinforced end frame to withstand abusive service. Electrical units are located for accessibility yet are fully protected from dirt and water; there is no wiring underfoot. Drilled floor plate encourages a clean cab. A mechanically operated contactor controller eliminates any possibility of sticking at the contacts, minimizes arcing. There is no electrical current through the main cylinders. A positive interlock makes it impossible to move the reverse handle without returning operating handle to "off" position.

There's no compromise with danger when Mancha's Storage Battery Locomotives are on the job. They are designed by men who know mining, who anticipate mining hazards and who act to offset trouble before it develops. In the case of Geco Mines, Ltd., a prominent new copper-zinc mine in Ontario, Canada, they went still a step further and worked directly with the mine staff to provide features that would make these locomotives safe all the way, particularly for the men who operate them.

At Geco, six Mancha 3½ ton, Titan BNs are in regular operation. The Trackmaster® design of these locomotives provides fully equalized support of the main frame on the axles and unusually good clearance beneath gear cases, a combination which improves safety by making derailment unlikely even where tracks are uneven and car or chute spillage a severe problem. Positive braking is assured by an easy to reach, quick acting, lever type mechanical brake that applies brake shoes equally to all four wheels. To compensate for shoe wear, brake take-up is easily adjusted from the cab. All rotating parts are supported by liberal size ball or roller bearings guaranteeing proper alignment and holding frictional losses to a minimum. Motor is heavy duty and oversize to permit adding that "extra car" on every train without fear of overheating. Simplicity of design throughout makes inspection easy, repair seldom necessary.

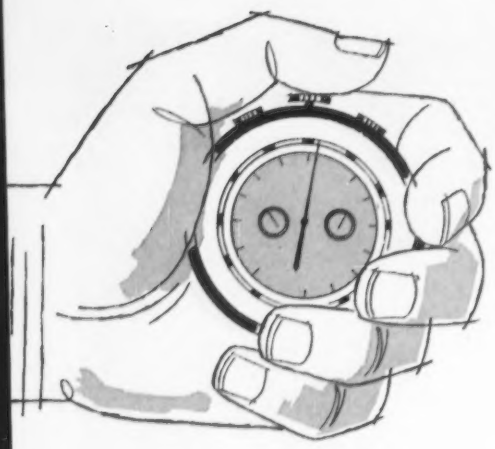
Mancha locomotives can pay in your mine, too. Let us recommend a unit to meet your requirements.

MANCHA STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago

Mancha representatives are located in principal mining areas throughout the world.



SECONDS SAVED

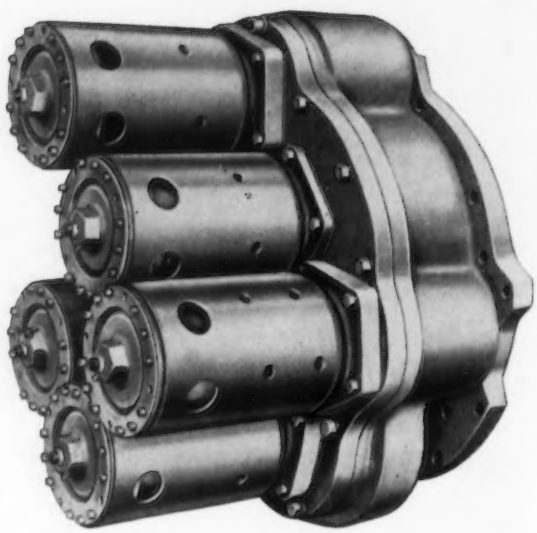
add up fast to give you ...bigger production ...bigger profits

Constant-mesh transmission on Tournatractor[R] saves shifting time

You can save as much as 80 minutes per 10-hr. day in your pit-tractor operations with instant shifting provided by Tournatractor's constant-mesh transmission.

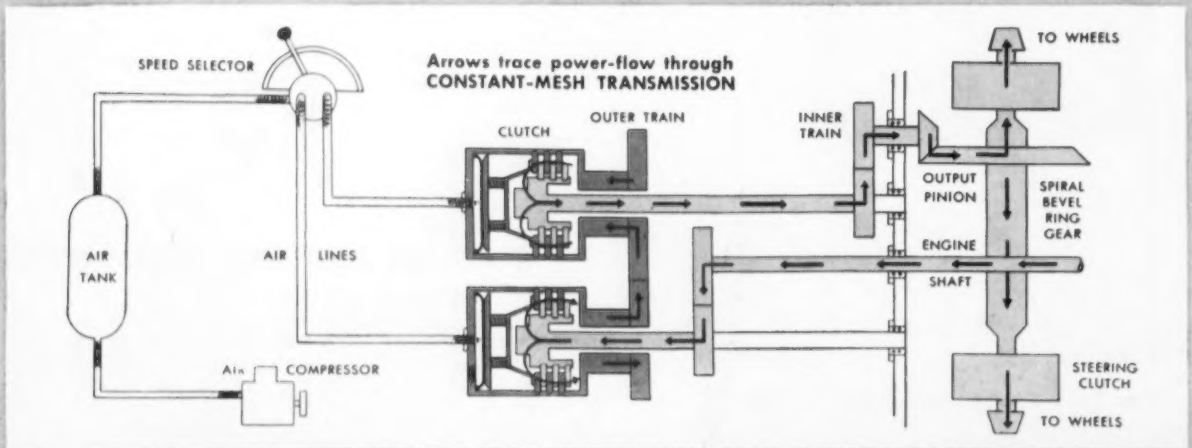
This transmission is operated by air clutches for fast, efficient gear changes. Mounted individually on the ends of the gear shafts, the clutches engage and release in proper combinations through the operation of a simple selector lever.

LeTourneau-Westinghouse constant-mesh transmission gives you non-stop, instantaneous speed-selection and high reverse speeds. There is no need to depress a clutch foot-pedal . . . no double-clutching . . . no meshing of one gear against another. With quick movement of the small speed selector, operator transfers power instantly from one gear ratio to another . . . with no gear clashing, no chance of locking out-of-gear. It gives faster pickup for drifting a load when dozing, and for pushing or pulling . . . gets more work done in less time!



Air-actuated transmission clutches save seconds — increase production. Each of the five 7" multiple-disc clutches in Tournatractor transmission has 290 square inches of positive gripping surface. These heavy-duty clutches engage and release in proper combinations at the touch of a control-lever. To make clutch adjustments, all you do is loosen a few Allen-head screws and turn adjusting ring "in" or "out". Transmission gears are fully enclosed and operate in a bath of oil. Lubrication points are conveniently located for quick, easy accessibility.

Copyright 1957 by LeTourneau-Westinghouse Co.



advertisement

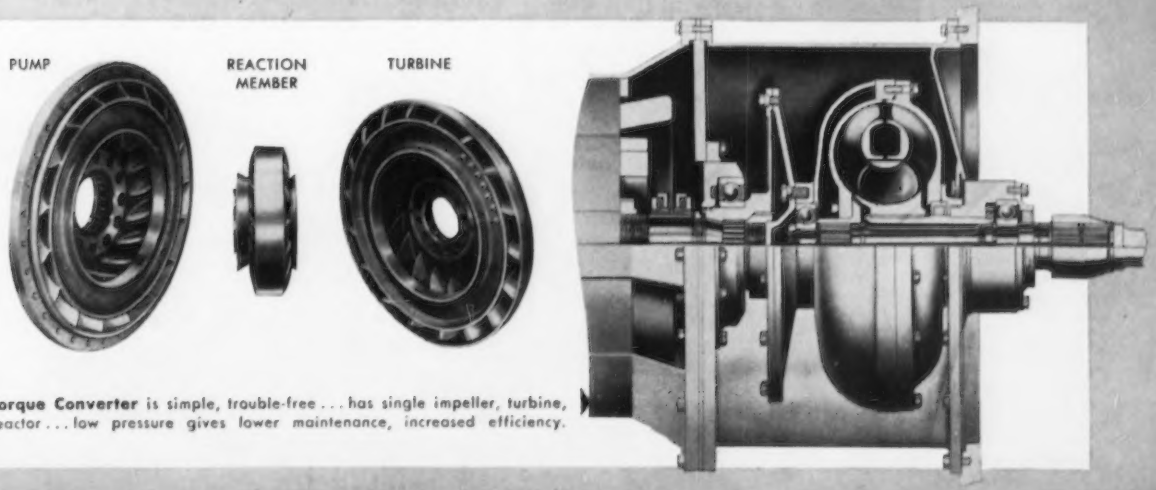
Torque converter saves seconds thru faster, more efficient operation

With Tournatractor's highly efficient single stage torque converter you get the equivalent of an infinite number of gear ratios within any gear range. It insures effective application of maximum horsepower at all times, over the complete speed range from 0.0 to 17.2 mph.

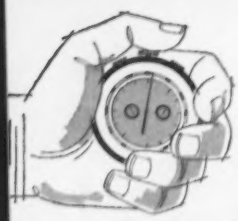
The LeTourneau-Westinghouse torque converter is a low-pressure unit, simple, and trouble-free. It has a single impeller, single turbine, and single reactor. Because it operates at low pressure, it is easy to keep the system sealed for lower maintenance.

Torque converter smooths out the shock of changing gears. It automatically balances load and torque, making gear selection less critical. Maximum efficiency is secured at *all* times by *all* of your operators. It automatically adjusts the speed ratio for more power, more speed, as needed. It provides you with better performance at all times in all your pit-tractor operations . . . dozing blasted rock on shovel clean-up, maintaining stockpiles, pushing gondolas, pulling other equipment, or maintaining haul-roads.

For more ways to save seconds that add up to bigger profits . . . see next page



Torque Converter is simple, trouble-free . . . has single impeller, turbine, reactor . . . low pressure gives lower maintenance, increased efficiency.

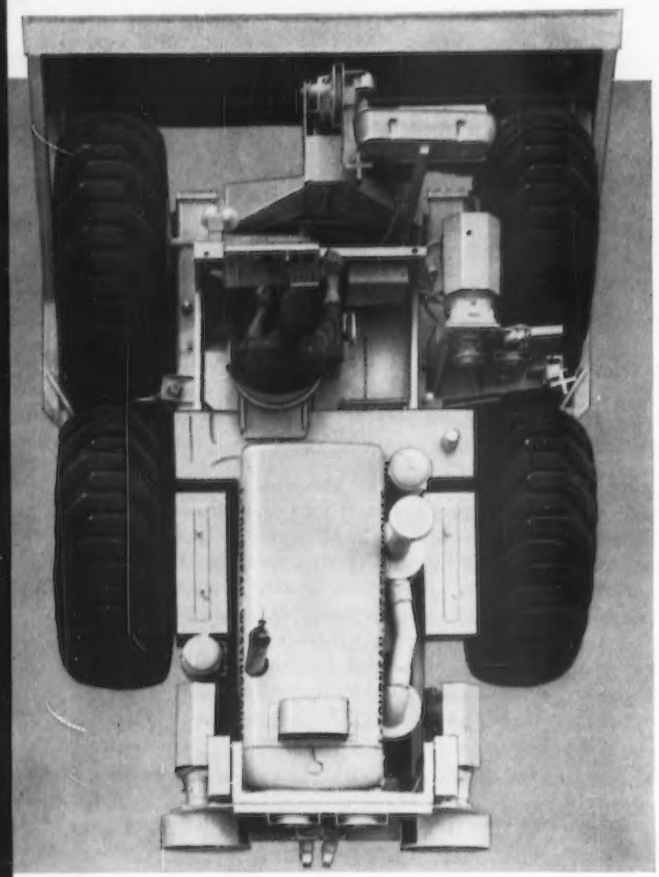


SECONDS SAVED...with

(continued)

FAST ACCURATE CONTROLS

at point-of-action



You save time with easier, faster operation of Tournatractor®

There's no faster control action possible than that provided by Tournatractor's instant-acting electric motor at point-of-action. Push a dashboard switch, and the motor starts instantly . . . reaches 1800 rpm from a standing start in just 1/5 second. At command of the switch, full power is reversed in opposite direction in ¼ second! A simple, spring-loaded, disc-type brake locks the motor automatically when switch is released.

With this motor control system, there is no more "feeling-in" of a clutch, or waiting for hydraulic pressure to build up. There are no more stresses and strains of mechanical stops . . . no slipping . . . no pause to build up power. Operator simply pushes the switch with his finger and gets instant action.

Electric power where you want it with flywheel-coupled generator

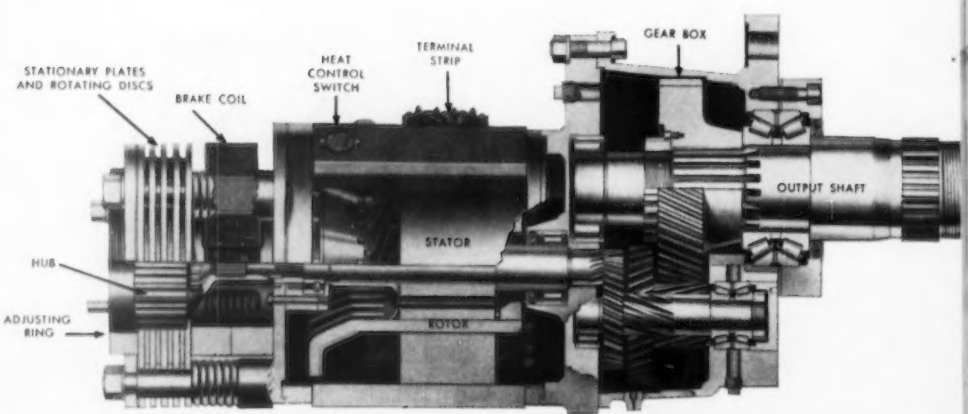
Power for electric controls, lights, and battery charging, is supplied by a heavy-duty AC generator mounted directly in line with engine, as part of the engine flywheel. Engine turns the generator rotor, which produces alternating current to operate point-of-action electric motor which powers blade action of Tournatractor.

Simple, weatherproof motors

Motor is mounted at point-of-control, where it works most effectively. Cable wear and expense is much lower than that of maintaining hydraulic or mechanical power-control units.

Motors are simple 3 phase, 300 volt AC design, with DC lugging power. They are brushless, compact, consisting of only 2 parts — a rotor and a stator. Rotor fan cools motor, blows out dust and moisture.

Simple, foolproof design makes motors waterproof, weatherproof. There is no change in control-action due to variations of climate or altitude. Motors are so effectively insulated that they continue to operate even when submerged in water.



advertisement LT

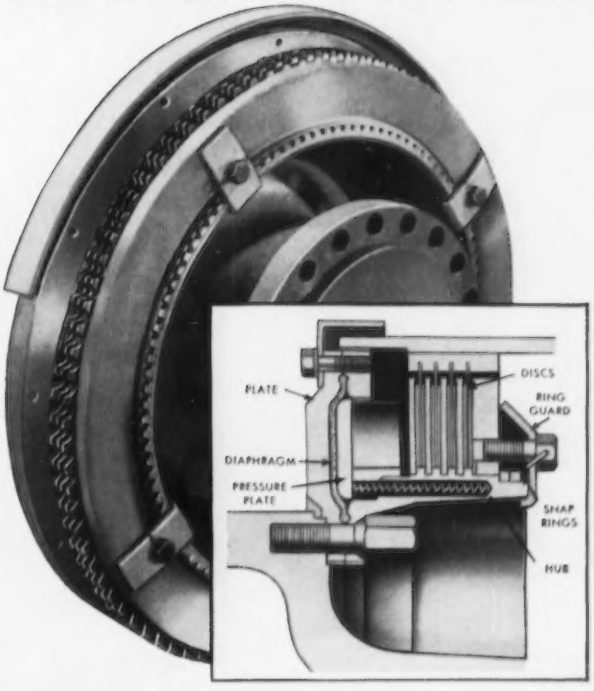
HEAVY-DUTY AIR BRAKES

with 3,762 sq. in. of brake surface

Complete safety on steep banks, narrow pit roads, around installations and equipment

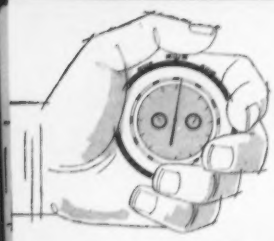
Heavy-duty air brakes on all four wheels provide 940 square inches of braking surface *on each wheel.* These improved air brakes consist of alternately-placed lined and plain steel discs. The lined discs, functioning as a brake-lining, spline to hub of wheel and turn with it. The unlined discs, functioning as a brake-drum, spline to axle and remain stationary. Pressure on brake-pedal operates air-valve which forces the multiple lined and steel discs together to slow or stop the big ground-gripping tires of the Tournatractor.

Master-valve equalizes air-pressure to each of the four wheels. Brakes respond instantly, evenly, to amount of air-pressure released by foot-pedal. Smooth and powerful, these air-brakes provide safe control in any weather, improve maneuverability. Operator has the confidence in his machine to work faster anywhere in your pit . . . on steep banks, twisting haul-roads, on narrow benches, and around shovels and other equipment on the pit floor.



Tournatractor brakes are compact . . . can be removed as an assembly from machine. Their large braking surface means fewer adjustments.

For more time saved with lower maintenance . . . see next page



SECONDS SAVED...

(continued)

WORKS MORE PRODUCTIVE

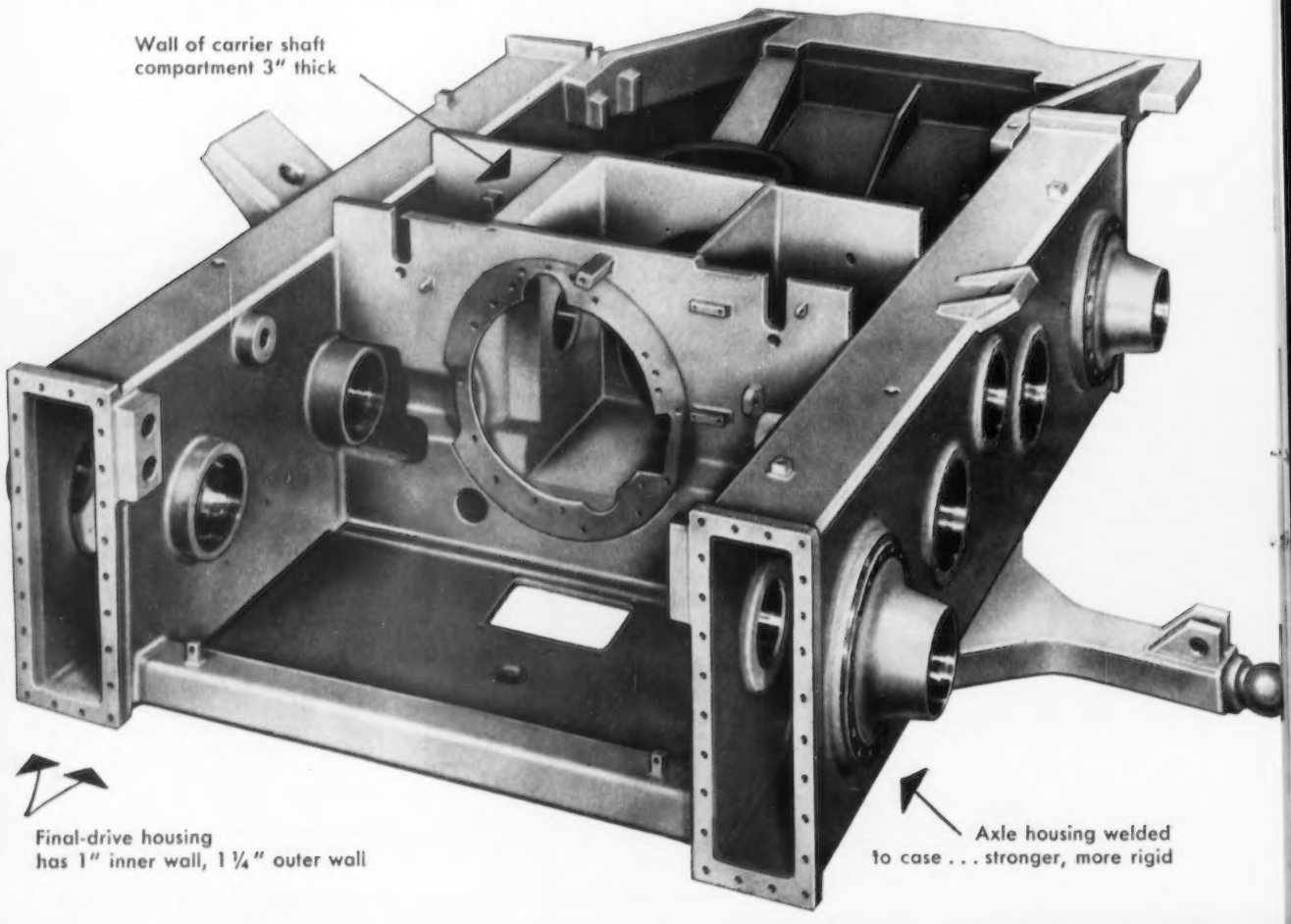
Low maintenance cuts downtime Tournatractor® on scattered pit

On Tournatractor, four rubber-tired wheels do the work of 450 to 550 parts in a crawler-track assembly. Obviously, less maintenance and less lubrication are involved to save time, increase profits.

Over 6 months of steady operation, your Tournatractor charts call for only 660 individual lubrication and regular maintenance operations. For the same period, a crawler may require as high as 1269 operations. That's twice as much service time as needed by Tournatractor. Crawlers require many mechanical service operations and the periodical rebuilding, or replacing, of track assemblies. Since these repairs are often put off, or neglected, because they may seem relatively unimportant, their rapid wear results in loss of efficient power.

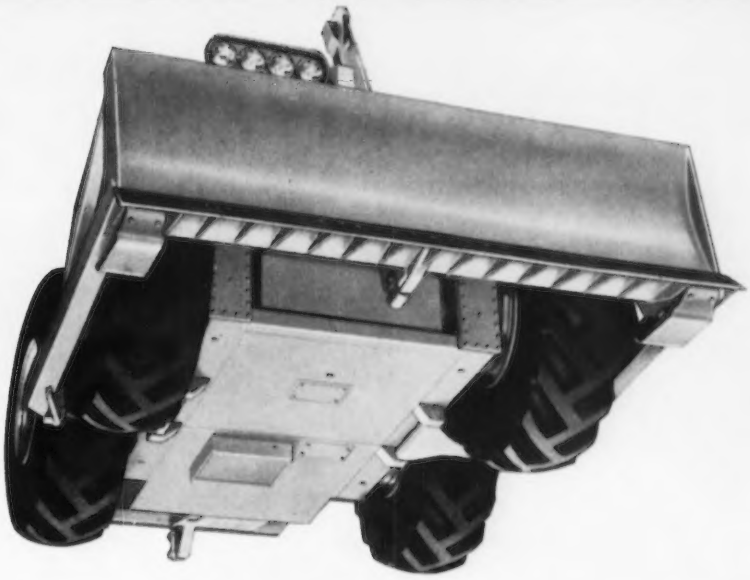
The big, flexing tires on Tournatractor are self-cleaning. Crawler tracks and grousers accumulate mud and grit, increasing wear and power loss. Service takes longer, because extensive cleaning is required for effective lubrication or repair of track assemblies.

Simplicity of electric control at point-of-action on Tournatractor is another feature that keeps mainten-


Wall of carrier shaft compartment 3" thick
Final-drive housing has 1" inner wall, 1 ¼" outer wall
Axle housing welded to case . . . stronger, more rigid

HOURS

for high-speed assignments



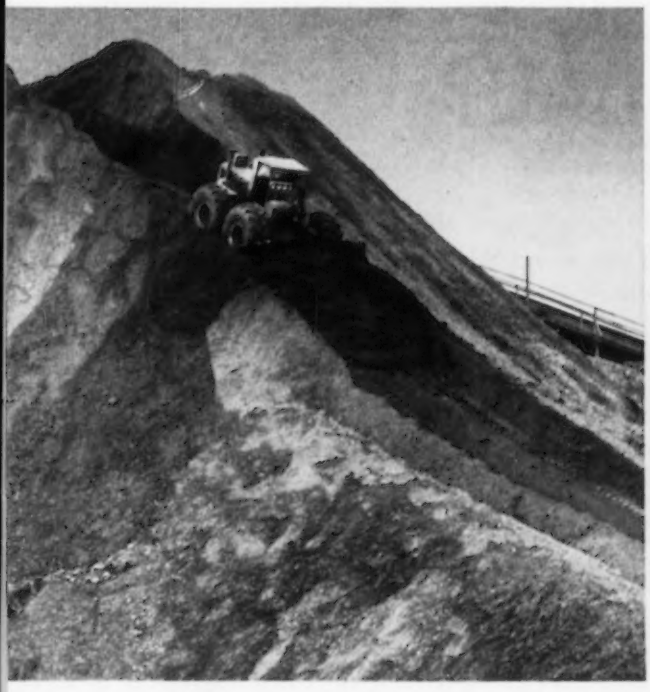
ance costs low . . . equipment efficiency high. Control cables are short to last longer. There is no hydraulic fluid to check and replace, no piping to service, no variation in operation, winter or summer.

Remember, too, that since initial cost of Tournatractor is less than crawlers of comparable engine horsepower, ownership cost is also lower. In addition, because of enclosed anti-friction drive, Tournatractor is better protected from wear, will give you longer life, and higher efficiency of high-speed performance during its lifetime.

Ask for more information

To save seconds that add up fast for greater work-capacity and bigger profits, it will pay you to look further into Tournatractor. Write or phone your LeTourneau-Westinghouse Distributor for free 32-page Tournatractor Bulletin, or ask for a demonstration on your job. See why this high-speed, rubber-tired tractor has faster acceleration, better maneuverability, lower maintenance, to give you the speed and mobility you need in your pit operation.

CT-1450-M



LeTourneau-**WESTINGHOUSE** Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Lifts 18 tons at a bite...

TIGER BRAND WIRE ROPE at work in the world's largest open pit mine where long service is the first requisite.

...works 24 hours a day

THERE'S NO REST for the Tiger Brand Wire Rope on this big shovel. It works continuously during the iron ore season and is subject to heavy loads, abrasion and fatigue.

Not all shovel ropes are suitable for all service requirements. Shovels vary as well as digging conditions. Therefore, shovel ropes must possess greater strength, greater abrasion and fatigue resistance. Tiger Brand Wire Rope is designed specially for these applications to give the best possible service.

To help you select the best wire rope for your equipment, call in the Tiger Brand Wire Rope Specialist. He can frequently save you money by recommending a better rope for the job.

AMERICAN STEEL & WIRE DIVISION
United States Steel, General Offices: Cleveland, Ohio
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

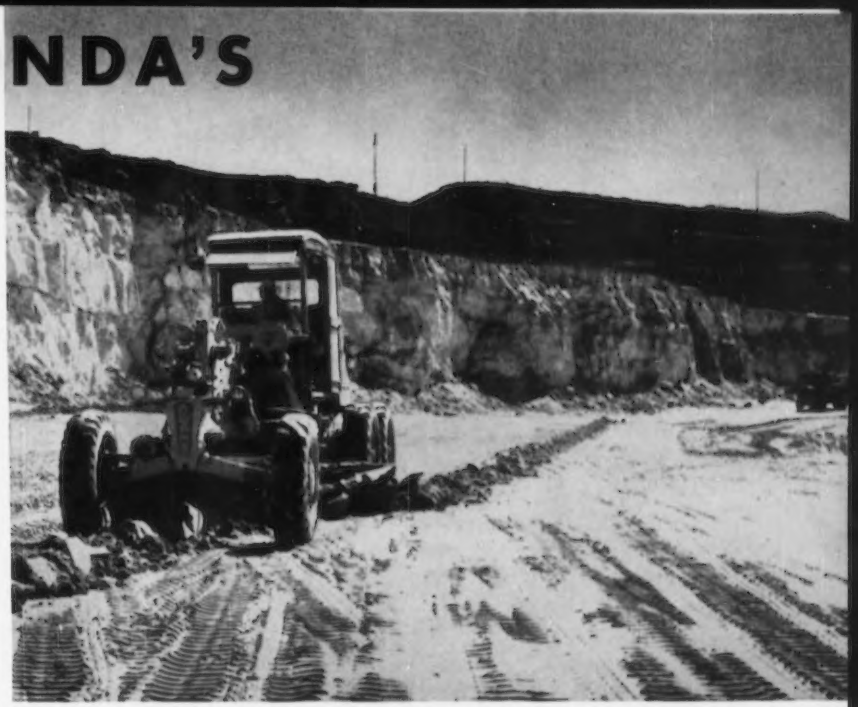
Excellay Preformed

USS

UNITED STATES STEEL

At ANACONDA'S Jackpile uranium mine:

30 miles of hauler-worn roads patrolled by ONE Adams* 550



At New Mexico uranium mine, debris dropped by passing haul units is quickly bladed aside by Adams 550 grader. Anaconda Company assigns this versatile unit to the job of keeping 25 to 30 mi. of pit haul-roads smooth and well-drained. These roads take pounding of heavy haul units 6 days a week.

Anaconda Company's 30 miles of pit haul-roads at its Jackpile uranium mine near Laguna, N.M., take the continual pounding of big haul rigs 16 hours a day, 6 days a week. To level and smooth these road surfaces — Anaconda uses one man and one machine: an Adams 550 grader.

This big 123 hp, 26,370-lb. rig has the power, weight and speed to handle the job fast and accurately. Its 8 forward and 4 reverse gears always give the operator "just right" power-speed ratio to work any type of material... give it high travel speeds to move fast to new jobs.

210 hp, 17 mph SwitchTractor helps one of Anaconda's big power shovels travel up an adverse grade. Main duties of this coupler-equipped tractor are heavy dozing at the pit, and switching of ore cars at the railhead.

Levels roads, clears away debris

At the pit, 6 power shovels work continuously to load 26 heavy-duty hauling units. A steady stream of heavy hauler traffic flows over the network of roads connecting Anaconda's pit with its various dumps and stockpiles. The fast-moving Adams grader patrols these busy roads; goes wherever needed to fill ruts, level ridges, clear debris sifting down from banks or dropped by over-loaded haulers.

Operator uses "550's" big 12′ wide blade to work loads of chipped rock, clay, and earth. Blade is fully rotatable on the circle... can be extended a full 7½′ outside line of wheels for shouldering. To trim banks, grader has a vertical reach of 12½′... outs at angles to 90°.

Utility SwitchTractor* dozes, switches

Anaconda uses another LeTourneau-Westinghouse unit to doze heavy clean-up around shovels, and for switching of ore cars at the railhead. It's the 210 hp, 17 mph SwitchTractor — a mobile, rubber-tired rig equipped with heavy-duty dozer blade in front, and a standard rail-car coupler in the rear. Dozer-switcher moves around wherever needed, handling a variety of jobs.

Cuts operating costs

Any pit operation shows more production... more profit... when a continuous pit and road clean-up policy is followed. Heavy-duty Adams 550 grader — with its wide selection of speeds — affords you dependable one-machine service in this important maintenance job. Like other big Adams graders, the "550" has a combination of operating features not found in any competitive unit. Ask for complete details.

An Adams Grader for every size job

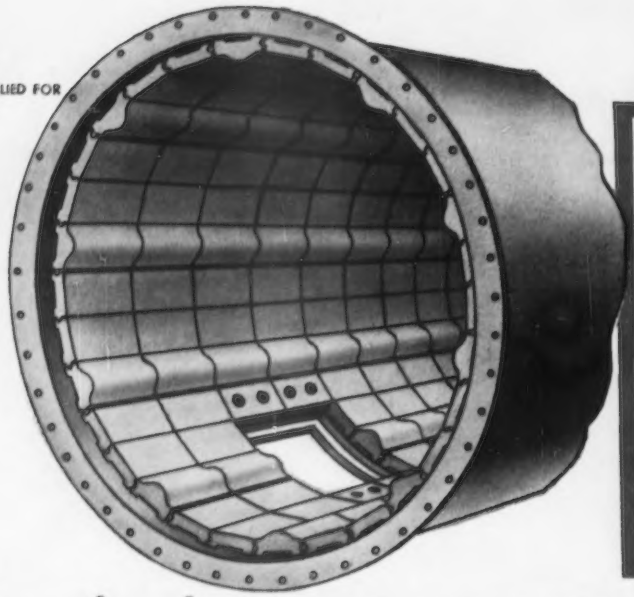
New POWER-Flow 660* — 190 hp with torque converter.....30,200 lbs.
Model 660* — 150 hp diesel....30,050 lbs.
Model 550* — 123 hp diesel....26,370 lbs.
Model 440* — 104 hp diesel....24,080 lbs.
Model 330* — 80 hp diesel....23,020 lbs.
Model 220 — 60 hp diesel....15,500 lbs.

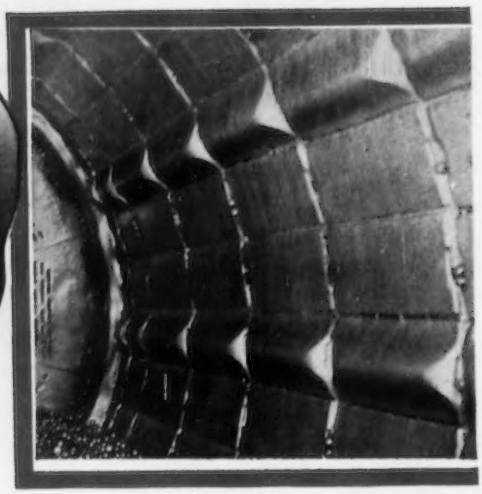
*Choice of GM or Cummins engine
(Weights shown are usual working weights.)
*Trademark AGST-1245-M-b-5

LeTourneau-**WESTINGHOUSE** Company, PEORIA, ILLINOIS
A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

PATENT APPLIED FOR





Standardize WITH B&W UNIVERSAL LINER PLATES

SAME CASTING FITS ALL MILL SIZES
B&W LINER PLATES RAISE PERFORMANCE, LOWER COSTS

The new B &W Tube Mill Liners have advantages that mean reduced costs in capital, time and labor.

Cost per ton of material ground is reduced, for the practical reasons listed below. Check them—you may find that one, or a combination, of these qualities will solve your existing problems.

- Lower Initial Costs—No pattern and chiller costs —the result of standardization.
- Longer life of liners—Uniform wear will result from better quality control on a mass production casting, utilizing permanent molds. Size is ideal for uniform chill and heat-treatment.
- Longer life for different applications can be realized by a selection of proper materials. This design lends itself to either chilled irons or wear steels.
- Direct labor cost and the "down-time" to install the liners are reduced. Castings are easily handled due to small size and weight. Less fatigue of workers. No cranes needed to handle lightweight liner castings.
- Cost reduced for storage space. Minimum storage space required as small castings "stack" easily. Records simplified with one design of casting interchangeable for all size mills.
- Saves money on liner inventory. One design fits all diameters of mills, permitting standardization. Quicker unloading and storage possible.
- Savings in breakage claims and delays for replacements. Hard brittle irons are frequently broken in shipment when large castings are used. Small castings are rugged and almost impossible to break by handling.
- Savings in determining most efficient wear pattern. Same castings will produce wear profiles consisting of all lifter ribs, all flats or combination of both, including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates, write The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.

BABCOCK & WILCOX

BOILER DIVISION

S-464

HAULS 4,000 TONS OF ROCK DAILY

Tournapull operator backs Rear-Dump up to edge of crusher, and flips electric hoist-switch. As body raises, rocks are dumped fast and safe. Body swings below and behind rear wheels, so rocks cannot obstruct wheels.

An abundant supply of base material was vital to Broce Construction Co., Dodge City, Kansas, when they began putting an 18″ base on a 10-mile section of highway. Nelson Bros. Quarries, La Harpe, contracted to supply Broce with more than 400,000 tons of stone and sand for necessary base material. In order to maintain the continuously high rate of aggregate production needed, Nelson Bros. relied on their 3 high-speed, 22-ton LeTourneau-Westinghouse C Tournapull Rear-Dumps. These fast-stepping haulers high-balled material from pit to crushing plant . . . hauled 4,000 tons of blast-rock daily per machine.

Note big 22-ton rock load in heavy, welded-steel Tournapull Rear-Dump body. On this rugged pit job machines successfully withstood much of this hard pounding.

Average 22 tons of rock per load

At Nelson Bros.' quarry, 3 mi. northwest of Reading, C Rear-Dumps worked with 2½-yd. shovel. Their short 90° turn radius enabled operator to maneuver machines easily, and spot fast under dipper. Each L-W Rear-Dump was loaded with 22 tons of blast-rock in 1¼ min. Rear-Dump's wide 8′9″ bowl, with low rear-entry, provided large, easy target area for shovel operator . . . reduced spillage and clean-up. Since shovel operator did not have to "lift" dipper high to get in and out of bowl, he saved valuable time on bucket's swing-cycle. This, plus time saved in hauling, maneuvering, and dumping, enabled Rear-Dump to make more round-trips . . . haul more tonnage per working-day.

Big brakes add safety on downhill hauls

'Pulls' multiple disc air brakes on all 4 wheels provided 3,762 sq. in. of braking surface for safe hauling on down-grades. At crusher, operator swung in fast . . . set rear-wheel brakes . . . and touched electric switch on control panel to activate hoist-motor and raise body. As bowl tilted, it swung discharge lip below and behind rear wheels . . . kept rocks from slipping underneath wheels as Rear-Dump fed load directly into crusher.

"These machines beat anything"

Supt. Carl A. Nelson reports his Tournapull haulers work profitably and efficiently. He said, "We have had excellent service from our Rear-Dumps. They haul from quarry pit to crusher, and have to take abuse on that type of work — but they are plenty rugged to take it." Nelson added, "They have plenty of power . . . can say we've had trouble-free service. We've worked all winter, in all kinds of weather. We can always depend on quick, easy starting on coldest days. These machines beat anything I've seen."

Heavy-duty haulers for tough jobs

For rugged, heavy-duty haulers to handle those tough jobs at your quarry, investigate the advantages of Tournapull Rear-Dumps. They take rough treatment . . . give you continuous high production. Call or write us for complete details.

Tournapull—Trademark Reg. U.S. Pat. Off. CR-1195-Q-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

VIBRATING PAN IS THE ANSWER!

Simplicity OS-A-VEYOR feeders lower maintenance and increase operating efficiency . . . LIMESTONE to TACONITE ORE

These Simplicity vibrating pan type feeders have proven themselves throughout the mining and quarry industry. They are not only handling various types of stone and aggregate, but the extremely abrasive taconite ore.

Lower maintenance costs have been proven by long experience in the field. The simplicity of the pan construction allows the unit to be easily repaired with existing materials. These feeders are available with replaceable liners of abrasion resistant steel. The oscillating action is provided by two eccentric shafts coupled to a single V-belt drive . . . leaving only one assembly and four bearings to lubricate.

The Simplicity Os-A-Veyor feeders are self-cleaning units. They experience none of the return spillage found in apron feeders. The Os-A-Veyor feeder will discharge material with a minimum fall, the height of drop is not determined by the size of a sprocket. The units are designed to handle heavy column loads. Overloading the feeders causes no damage, as there is no mechanical connection between the eccentric drive and the main frame or bin.

The Simplicity Os-A-Veyor feeders are main frame supported, or can be supported from the bin with spring and cable suspension, eliminating the need for separate concrete foundation. Sizes available range from 1' x 4' to 6' x 20' with capacities to 1000 tons per hour.

169

If you wish further information on Simplicity Os-A-Veyor feeders, grizzly feeders, horizontal screens or gyrating screens write . .

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown and Sites, 50 Church St., New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED
ENGINEERING COMPANY • DURAND 4, MICHIGAN

Prospecting. The Universal 'Jeep'* with the extra traction of its 4-wheel drive, takes men and equipment anywhere on the lease for prospecting, exploring or survey work. It climbs grades as steep as 60%, goes where other vehicles can't go.

Speed your mining operations with 'Jeep' versatility and all-wheel traction!

The completely new Forward Control 'Jeep' FC-150 Truck. It's the first time a 4-wheel drive truck has so effectively combined so much cargo capacity (74-inch pickup box), with such exceptional "go-anywhere" maneuverability (81-inch wheelbase).

Mobile power. The versatile 'Jeep' gets to the job with sure dependability, and with power take-off supplies its own power to operate a portable drill, above. It also operates winches, welders, compressors, generators and many other types of equipment.

Rugged 'Jeep' vehicles are always on-the-job, in virtually every phase of mining. From initial surveys to transportation of men and equipment in the field, they help keep operations on schedule every day of the year.

No other vehicles match the 'Jeep' family for all-around mobility, range of performance and go-anywhere ability. On the highway they travel at top legal speeds in conventional 2-wheel drive. But, when the going gets tough, the extra traction of their 4-wheel drive hauls trailers in trackless mining, or carries personnel with parts and supplies over rugged terrain, through mud, snow or soft earth – in good weather or bad – to help keep maintenance and service work moving smoothly. These vehicles go where others stop cold in the heavy, rough going of mining projects.

'Jeep' vehicles supplement heavy-duty equipment, spread their costs over a wide variety of jobs, give you additional savings through long life and low maintenance costs. Ask your Willys dealer for a practical, on-the-job demonstration.

The 'Jeep'®

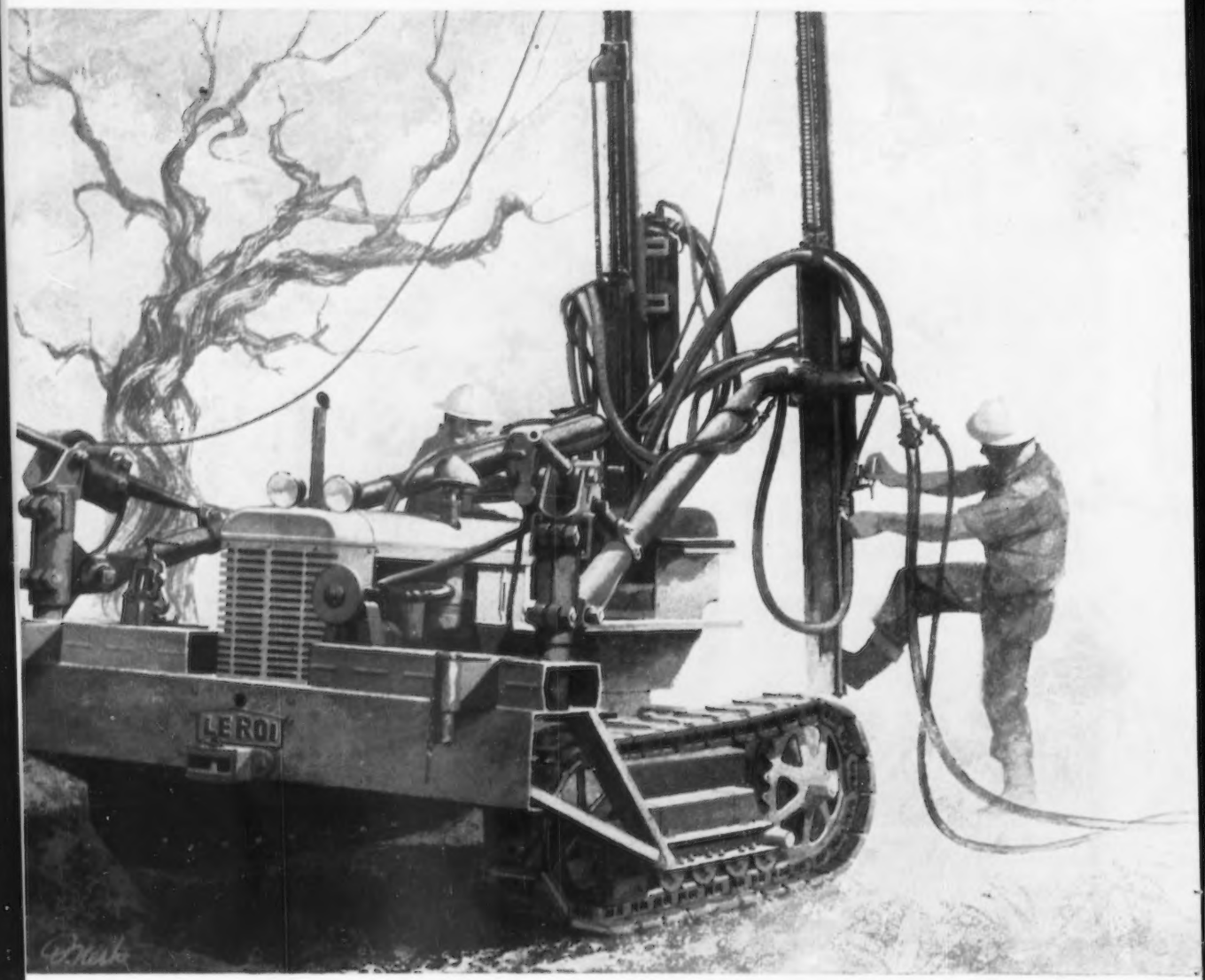
family of 4-Wheel-Drive Vehicles

WILLYS... makers of the world's most useful vehicles

**Model CJ-5 shown*

WILLYS MOTORS, INC., TOLEDO 1, OHIO

LeRoi Dual Drill Rigs



Check these comparative features!

mobility:

1.

The T-286 can quickly speed across job-sites without compressor power.

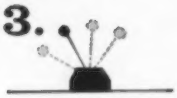
The air-driven track-type wagon drill can't move without an air compressor — must be loaded and unloaded by a crane.

2.

The T-286 unit can travel 7 mph — and pull the compressor, too!

The air-driven unit can only travel 3 mph.

3.



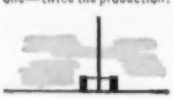
The T-286 has three forward speeds for better control, faster movement.

The air-driven unit has but one forward speed.

cost:

4.

The T-286 costs 20% more than an air-driven track-type wagon drill, BUT you get two drills instead of one—twice the production!



5.

The T-286 tractor unit alone costs slightly more than the track-type drill carrier, but it has extra usefulness—does other tractor work when not drilling.

T-286 unit features more power and speed for quicker positioning than track-type wagon drills.

Out-perform All Others!

Air motors do all the drill positioning, relieve most of the manual work

The Le Roi T-286 is a dual-drill rig mounted on a 28 hp crawler tractor. It gives you twice the production of competitive single-drill self-propelled units — yet costs only slightly more.

Its power and speed exceed that of other crawler wagon drills, giving faster movement across job-sites . . . quicker positioning . . . higher production.

Besides being a major time-saver, the tractor is useful after rock-work is completed; drills can be easily removed to permit use in cleanup work and other odd jobs. Yet the tractor itself costs only slightly more than a slow-speed air-driven self-propelled drill carrier!

Goes Anywhere

The T-286 is ideal for work-sites that are inaccessible to standard-type drill rigs. It can easily travel to places where manual positioning of wagon drills is slow and impractical — quickly reaches spots formerly drilled only with even slower and doubly back-breaking hand-held rock drills!

The crawler tractor takes rough ground easily. A parking brake and two leveling jacks stabilize the tractor while drilling on rough or uneven ground.

In operation, air motors position the drill arms through a wide arc, permitting easy, quick setups for any number of holes without relocating the machine. Each arm has a 7 ft. radius through 220 degrees . . . distance between drills is a maximum of 24 feet, allowing a variable drill pattern.

Drills High or Low Holes

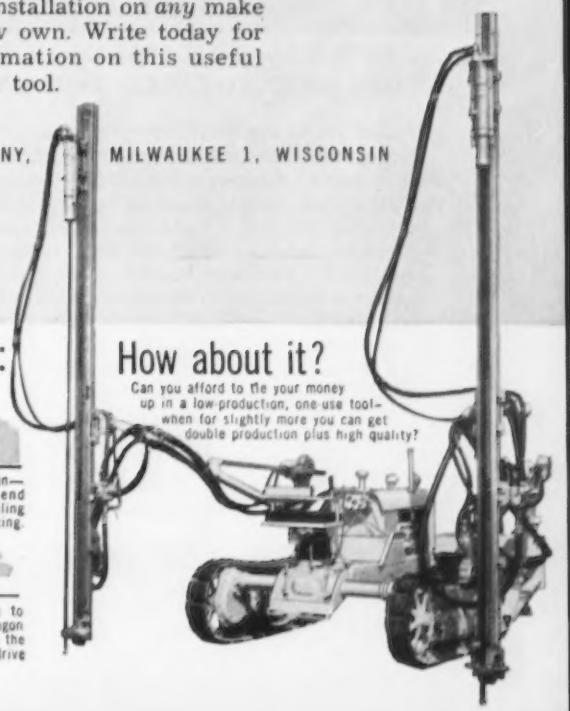
Air motors change the positioning of the air feeds, too, through 360 degrees. This means easy placement of horizontal flat holes as high as 9 feet above ground level, as well as toe holes either backward or forward. Feed is positive whether the drill is being fed forward or retracting, giving faster drilling with both steel and tungsten carbide tipped bits.

The heavy-duty feed allows the use of either 3½ in. or 4 in. drifter with 10 ft. travel and 8 ft. steel change as standard equipment. Other size steel changes are available.

The dual drill rig may be bought separately for installation on *any* make tractor you now own. Write today for complete information on this useful high-production tool.

LE ROI DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY, MILWAUKEE 1, WISCONSIN

MANUFACTURERS OF CLEVELAND AIR TOOLS, TRACTAIR®, PORTABLE AND STATIONARY AIR COMPRESSORS, AND HEAVY-DUTY INDUSTRIAL ENGINES. WRITE US FOR INFORMATION ON ANY OF THESE PRODUCTS.



production:

6.

With its double drills, the T-286 can put down twice the footage of any air-driven wagon drill; handles holes up to 2¾ inch and depths to 24 ft.

7.

The T-286 can put in many holes—10, 20 or 30 — from one tractor setting. Wasteful moving and set-up time is eliminated.

The air-driven wagon drill puts down one hole per setting — must be repositioned for each hole.

utility:

8.

The T-286 has multiple uses—can do odd jobs, towing, cleanup work when drilling job is completed.

The air-driven wagon drill has only one use — is a dead investment when not drilling.

manpower:

9.

The T-286 needs two men—but both of them spend most of their time drilling — making hole — producing.

It also takes two men to operate the air-driven wagon drill, but only one is on the drill—the other must drive and position.

How about it?

Can you afford to tie your money up in a low-production, one-use tool—when for slightly more you can get double production plus high quality?

free-machining

MAX-EL 3½ ALLOY STEEL

gives parts like these high strength, toughness

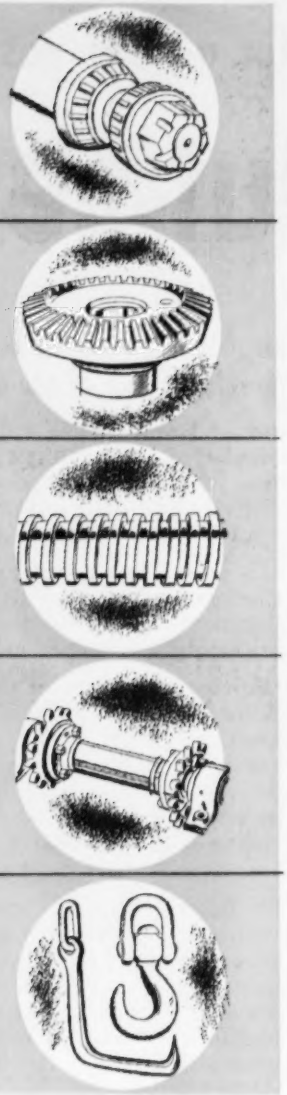
AXLES

GEARS

JACK LIFTING SCREWS

SHAFTS

HANDLING TOOLS



...AND YOU CAN MACHINE EVEN INTRICATE PARTS FROM HEAT-TREATED AND STRESS-RELIEVED BARS

Max-el 3½ is the ideal general-purpose steel for mining and construction shops. It has all the properties needed for rugged applications: toughness, strength, resistance to wear and impact. More than that, you can buy it from your nearby Crucible warehouse in heat-treated and stress-relieved bars — in the diameters and lengths you need — which do not require final heat treatment after machining.

Factors like these enable you to speed up repairs whether you make them in the field or in the shop. As a result, you cut down-time and repair costs — get your equipment back on the line faster. Then, too, parts made of Max-el 3½ last longer even on jobs where they're in continual rugged service.

Because of Crucible's methods of manufacturing and quality control, Max-el 3½ is made in extremely accurate sections and straighter bars, in a complete range of sizes and shapes. All Crucible warehouses carry complete stocks so that, in many cases, you get 24-hour delivery of whatever quantity you need.

Like more information? Write: *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

E&MJ NEW PRODUCTS DIGEST

Study Shows Turbodrills Can Cut Costs (1)

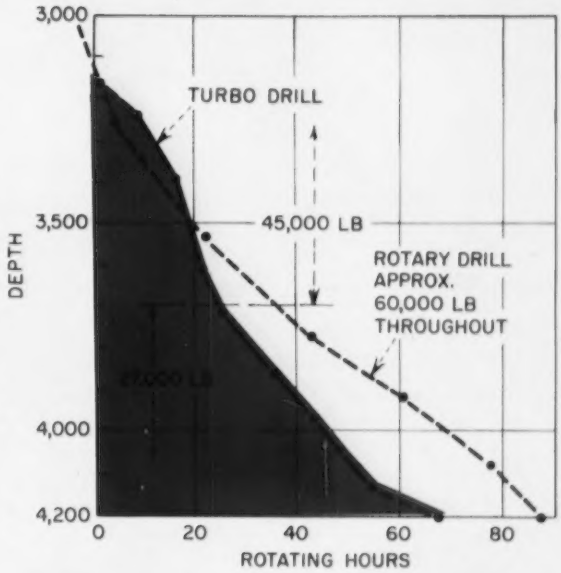
In a press release accompanied by a proof of an article from May issue of *Monitor*, Dresser Industries' abstract publication for the oil industry, Dresser Industries reported on progress with the Turbodrill for past six months.

While tests to date have proven that the Turbodrill can cut costs, Dresser is not yet ready to market the drill. Dresser wants to develop a new bit that can keep up with Turbodrill's horsepower and speed, before marketing the unit.

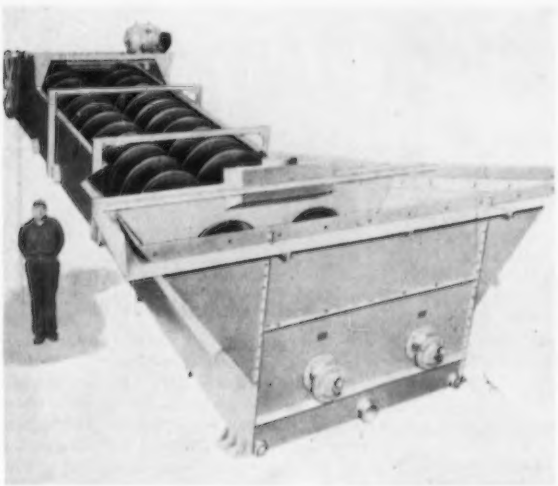
Opinion of oilwell drillers conducting tests is that the Turbodrill is a satisfactory, powerful down-the-hole-drilling machine, suitable for oilwell use, and that the drill operates in a trouble-free manner. Turbodrill can definitely increase bit penetration rates. Under certain conditions, conventional off-the-shelf rock bits, such as those manufactured by Dressers' Security Engineering Div., are capable of transmitting the Turbodrill's higher speeds and horsepower to full use. And when the Turbodrill is used for hole opening, the drill string vibration is reduced considerably and higher bit weights can be used.

Chart at right shows Turbodrill vs rotary drill in 12¼-in. hole through lime, chert and sand in the Permian Basin, west Texas. Crooked-hole conditions prevailed. Weight on bit was reduced as shown on chart. From 3,195 to 3,382 ft, Turbodrill footage was 132% of rotary, penetration rate was 3.6 times rotary and cost per foot was 57% less than rotary.

In the lower portion of the holes, 4,038 to 4,200 ft, the Turbodrill footage was 122% of the rotary, penetration rate was 2.8 times rotary and cost per foot was 31% less than the rotary.



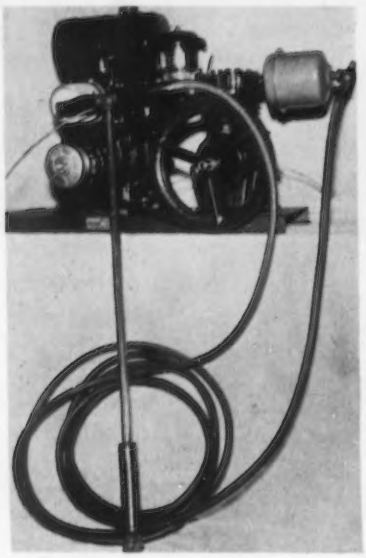
But comparing the Turbodrill and the rotary in the 3,260- to 4,127-ft range, the Turbodrill footage was only 60% of the rotary, penetration rate was twice the rotary and cost per foot was only 5% less than the rotary.



Spiral Classifier for Fine Material (2)

Eagle Iron Works is introducing a 54-in. dia spiral classifier in both single and double screw design. Screw diameter is 54-in. in a tub length of 34 ft. Normal screw speed is 14 rpm. Capacity of the single screw is 250 tph and that of the double screw is 500 tpd, depending upon size of separation. Screw is ribbon type, a sheet of steel spiral-welded to the shaft, with replaceable Ni-Hard chrome nickel alloy shoes on the edge of the screw. Single screw unit weighs 26,000 lb, while double screw weight reaches 50,000 lb.

Continued on p 36. For more information on these items, use card opposite p 42.

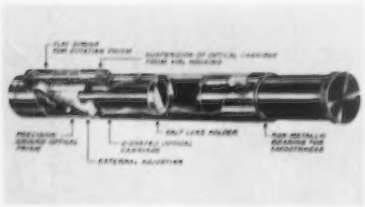


Down-The-Hole Principle Applied to a Hand Drill (7)

Powermite Drill & Tool Co.'s down-the-hole drill consists of a small diameter hammer barrel whose piston strikes directly on the bit shank at the bottom of the drill hole. Exhaust is located near the drill and keeps the hole clean in most circumstances. Barrel is attached to a T-handle by the drill rod or to the Anglehead handle which provides rotary motion to the bit.

With T-handle, horizontal holes can be drilled to 35 ft. Using an Anglehead, drill rig, above, is drilling 30-in. deep holes from platform above 40-ft shaft.

New Exploration Aids



Lightweight Hand Level (4)

Locke-type hand level manufactured by Stratex Instrument Co., Inc. is made of aluminum finished in synthetic corundum. No heavy brass alloys are used. Eyepiece has non-metallic tube bearing. Cross hair is engraved on an optical glass index prism which can be adjusted from the outside of the level with a penknife.

Portable Seismograph (5)

Newly designed portable seismograph developed by University of Cambridge combines rugged, compact construction with observatory sensitivity, according to Jarrell-Ash Co. Produced by Hilger & Watts Ltd., the Watts Willmore Pattern Seismograph, records for up to 24 hr at 60 mm per minute with needle-sharp definition, and is designed for a variety of geophysical uses.

Self Leveling Attachment (6)

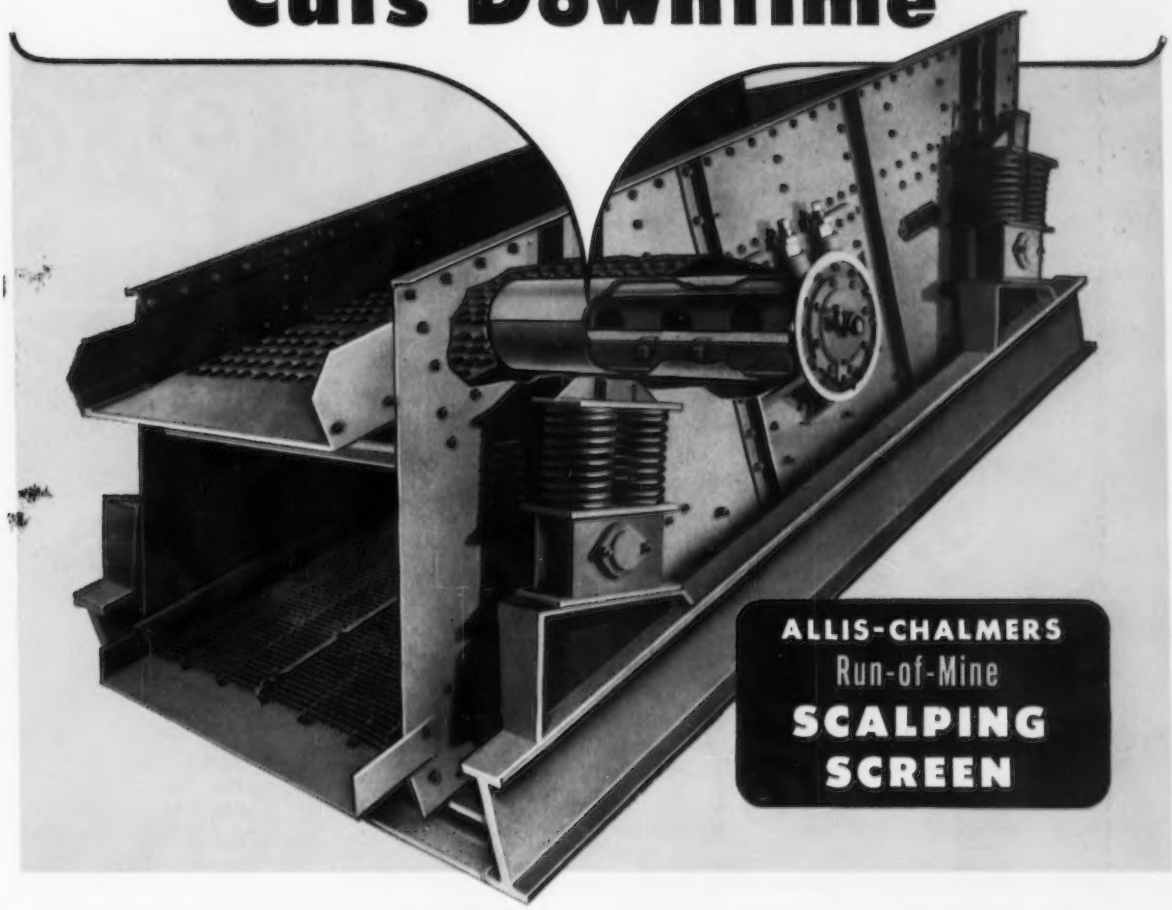
Small and compact instrument can be attached by an adapter to the objective end of a telescope of any make, or a transit. When in place, it is not necessary to adjust the level or transit carefully before each sighting, according to David White Instrument Co.

Walking Magnetometer (3)

According to Radiac Co., the Walking Magnetometer is the foot prospector's answer to the Flying Magnetometer. Unit can be used to locate and trace magnetic and non-magnetic anomalies, and can be operated over areas covered by muskeg, snow, water and overburden. Device weighs 12 lb.

For more information, use card opposite p 42.

Replaceable Cartridge Mechanism Cuts Downtime



CHANGING this screen mechanism is as simple as changing a battery in your car. All you do is remove four bolts and slide out the entire mechanism.

The cartridge mechanism gives you the added advantage of taking it to your maintenance bay or shop where all facilities are handy and maintenance costs are lowest.

If your process involves a multiple installation, it is highly profitable to keep a replacement mechanism in reserve. Slip one out, slide another in. Keeping production flowing is as easy as that.

Other Maintenance-Reducing Features

The proven simplicity and record-low maintenance of two-bearing design . . . largest, most sturdy bearings ever installed on a vibrating screen . . . multiple (two sets per corner) steel support springs that prevent transfer of vibration to structure even when materials stick to screen . . . sealed-in mechanism with single grease seal on drive side that eliminates multiple possibilities of dirt infiltration — all these features keep maintenance cost low.

For complete information, see your nearby Allis-Chalmers representative or write for Bulletin 07B8368. Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis.

A-5194

ALLIS-CHALMERS

In carrier landings, planes coming in at more than 100 knots are stopped in a split second. This amazing performance is made possible by having each plane hook onto one of several wire ropes stretched across the flight deck. Both plane and rope receive an almost unbelievable shock at the moment of contact. Needless to say, only top-quality wire ropes can be used for this application because . . .

you can't bargain with safety

While your use of wire rope differs from this carrier application, *safety should be just as important to you.* For, although a "bargain" rope may save you money, it can cost you your peace of mind. So don't bargain with safety. Buy a rope that's a *quality* rope—buy Wickwire Rope. 5049

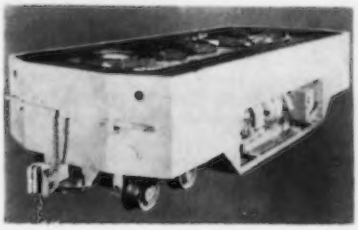
WICKWIRE ROPE — A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emienton (Pa.) • New Orleans
New York • Philadelphia



Mine Fire Truck (12)

Model 2100 MSA Mine Fire Truck, manufactured by Mine Safety Appliances Co., has capacity of 2,100 gal of water, motor, pump and hose in one compact unit. Truck runs on eight rollerbearing wheels. It is 18 ft long, 7 ft wide and 50 in. high. Model 2100 carries 200 ft of single conductor cable on spool at the rear of the truck.

Diesel Man Truck (13)

Designed for narrow drifts and low head room, Oretruck Mfg. Div. Ortruc Inc.'s Personnel Carrier is powered by 4-cylinder GM diesel. Model shown here is used at Pond Oreille to carry tools, equipment and men. Truck is 14 ft 7 in. long, 6 ft wide with an over all height of 5 ft 4 in.

Mining Equipment—Drills, Bits and Rigs

Diamond Core Drill (9)

Surface set diamond coring bits in standard sizes from EXT to 7¾ in. dia are now available from Diamond Products, Inc. Diamonds are set in choice of three matrices—standard for non-abrasive, relatively solid, good coring ground; hard for somewhat abrasive or fair coring ground; and super hard for extremely abrasive or badly broken and difficult formations.

Down-The-Hole Bits (11)

Both 6 and 6½-in. Brunner & Lay Hole-Master bits for use with down-the-hole drills have been added to the company's line of percussion rock drills. The spline body is a super-tough steel with fast drilling carbide inserts that have unusual resistance to wear and shock, according to the manufacturer.

Self-Propelled Drill (8)

Knee-action crawler drill, called the Crawl-IR by Ingersoll-Rand, is completely mechanized, self-propelled. Crawler is driven by air motors. All boom and feed tower adjustments are hydraulically controlled. Boom will swing in 85-deg horizontal arc and an 82-deg vertical arc. Boom is 5½ ft long and the feed tower is 15 ft high. Bit sizes available are 2¾, 3, and 3½ in.

For more details use card opposite p 42.

A COMPLETE REFRACTORIES SERVICE . . . *for the Copper Industry*

Three types of basic brick—RITEX, GREFCO, STEELKLAD for the three basic processes—smelting, converting and refining. Each type of brick available in the ranges of composition—Magnesite, Magnesite-Chrome, Chrome-Magnesite and Chrome—required to adapt to variations in metallurgical processing.

RITEX—chemically bonded for low cost, superior workmanship, resistance to spalling, ready availability.

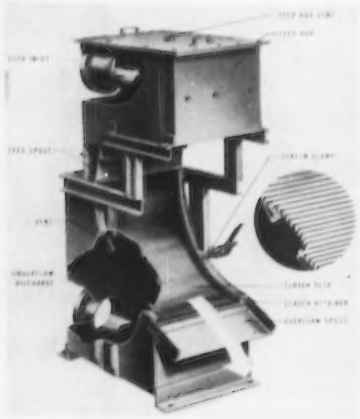
GREFCO—conventional type bonded by tunnel kiln high temperature firing, for maximum strength and hardness.

STEELKLAD—steel encased on two, three or four sides and for special jobs, steel plates incorporated in the brick interior as well—for maximum resistance to spalling in the most severely treated exposed walls.

RITEX, GREFCO and STEELKLAD—each the result of many years of intimate knowledge of the copper industry and careful study of service conditions, each prepared from the best available raw materials and made with the most modern manufacturing facilities—all within easy access to your operation.

GENERAL REFRACTORIES CO.
Philadelphia 2, Pa.

GENERAL REFRACTORIES



DSM Screen for Wet Screen (19)

Stationary screen is particularly adaptable to separations in the 8 to 48 mesh range and to date has been successfully applied to classifications in the metallurgical, non-metallic and chemical industries on slurries containing non-fibrous solids. Dorr-Oliver Inc. holds patent rights from Dutch State Mines. DSM screen is a concave, horizontal wedge-bar screen in a stationary housing. Particle separation is controlled by the width of openings between the stainless steel wedge bars. Installed and operating costs are low as no power is required for operation and the absence of moving parts keeps maintenance down. Unit is small and compact. Dorr-Oliver says that the screen is available in four sizes ranging in width from one to four ft. Capacity is approximately 200 gpm per foot of screen width at 48 mesh and 500 gpm at 8 mesh. Wedge bars can be reversed.

Panel-Mounted Hygrometer (22)

Beckman Instruments, Inc. Panel Mounted Electrolytic Hydrometer automatically and continuously measures water concentrations in vapor samples with a 5% accuracy in the 0 to 1,000 parts per million range in temperatures up to 100 deg C.

Portable Thermocouple (23)

Designed for high temperature molten metal measurements up to 3,100 deg F, this thermocouple uses a metal-ceramic LT-1 secondary protecting tube, vitrified alumina primary tube and a platinum-platinum 10% rhodium thermocouple. Bristol Co. says that the standard model has 8 ft of armored connecting wire. Tests show that the metal-ceramic LT-1 secondary tube can withstand about 10 dips in molten steel between 2,700 and 3,100 deg. F.

Antifoam Agent (20)

Hodag Chemical Corp. has developed an antifoam agent from a fractionated vegetable oil. Product is designed for city sewage treatment plants, but has applications in many chemical and hydrometallurgical problems. Can it kill flotation froth on a thickener?

Multiple Sight Oilers (21)

Multiple sight oilers automatically deliver measured amount of oil or reagent to up to 24 outlets. Unit can be manually or fully automatically controlled. Reservoirs are plastic or pyrex glass. Available in 10 oz, 1 pt, 1 qt or 2½ qt sizes, with ¼-in. fittings, according to Trico Fuse Mfg. Co.

Vibrators (28)

New series of Vibrolators, capable of operating in any position, on steam, compressed air or gas, or vacuum, are now available from Martin Engineering Co. Units are available in ten sizes ranging from a few ounces to 15 lb in weight, for vibrating jobs up to freight-car proportions.

New Tools for Metallurgists

Air-Operated Take-Off (31)

Twin Disc Clutch Co.'s air-operated power take-off is available for engines up to 600 hp output. Air pressure of 90 to 100 psi will produce all the torque normally needed, but 130 psi can be used.

Variable Density Goggles (32)

These war surplus goggles will permit the operator to adjust the light density from thin smoke shade to near black-out, according to Edmund Scientific Co.

Air Compressor (33)

Ingersoll-Rand Co. has available a new air compressor called the Channel-Flo. It is a 2-stage, 200-psig rated motor-compressor in 1½ and 2 hp sizes. Complete packaged unit, includes the motor-compressor, cushion mounted vertical tank, piping, fitting and start-stop control.

Neoprene Impeller Pump (29)

Self-priming pump that operates quietly and effectively in either direction, at high or low speeds, is now available from American Machine Products, Inc. Pump is bronze with Neoprene impeller on stainless steel shaft. Will handle most liquids at 7½ gpm at 10 psi on ⅓ hp motor at 1,750 rpm.

AC Generator (30)

Attached to a truck or tractor, this heavy-duty electric generator will provide 115v single-phase ac power, according to manufacturer, Electric Controls, Inc. Two models are available that can deliver 1,500 and 3,500 watts respectively.

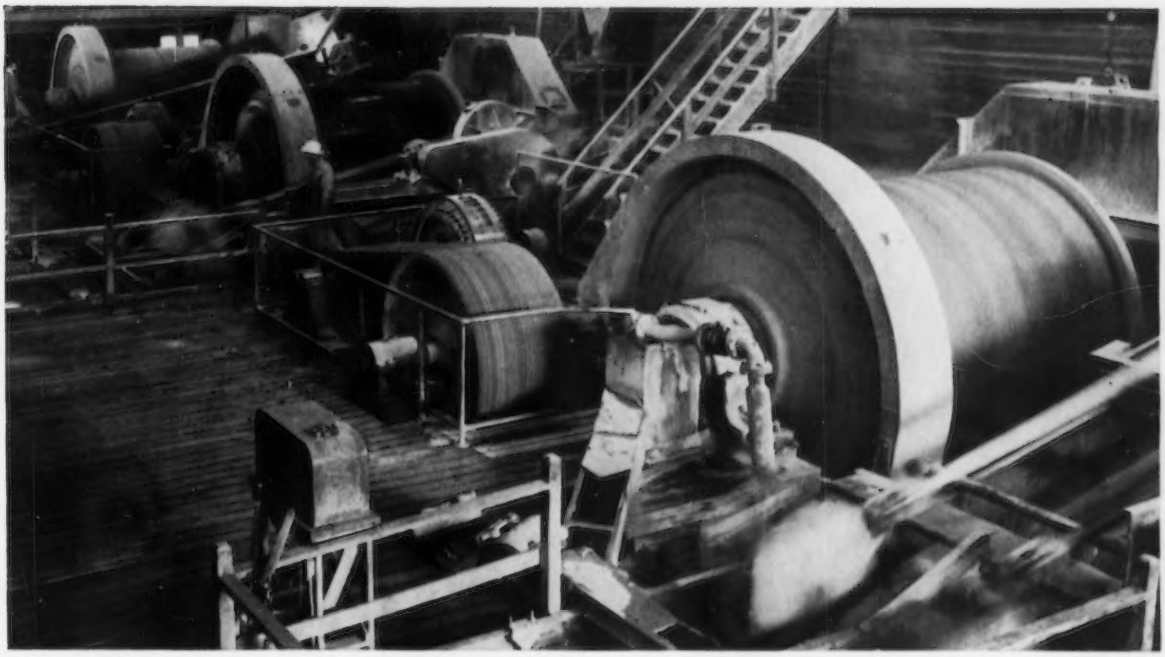
For more information, use card opposite p 42.

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON GEAR COMPOUND

FIRM BAGDAD COPPER CORP.
Bagdad, Arizona

Not one gear failure using Chevron Gear Compound



During 5 years that Bagdad Copper Corp. has used Chevron Gear Compound (formerly Calol) in its ore concentrator mill, not a single gear has broken down, required repair or replacement as a result of lubricant failure. Despite continuous operation and extreme pressure, gear teeth show no scuffing or galling. Mill moves some 4,000 tons of ore through its four ball mills and classifiers every 24 hours.

Enclosed gears of firm's four Western Machinery classifiers are lubricated with Chevron Gear Compound. Copper ore is pulverized in ball mills by tumbling with 32 tons of 3" steel balls. Classifiers then screen out oversize pieces for return to ball mills. Reduction gear box which Master Mechanic Al Smith is inspecting (above) powers connecting arms which agitate mixture of pulverized ore and water in classifier.

Why Chevron Gear Compound protects enclosed gears

- Tough film protects gear teeth against scuffing and scoring under severe shock, load conditions.
- Highly adhesive...clings to gear teeth and bearings, even under wet operating conditions.
- Oiliness additive reduces friction

For More Information on this product contact your nearest representative, or write direct to any company listed.

CHEVRON Industrial Lubricants

TRADEMARK "CHEVRON" AND "CHEVRON" DESIGN REG. U.S. PAT. OFF.

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THE CALIFORNIA COMPANY, P. O. Box 780 • Denver 1, Colorado

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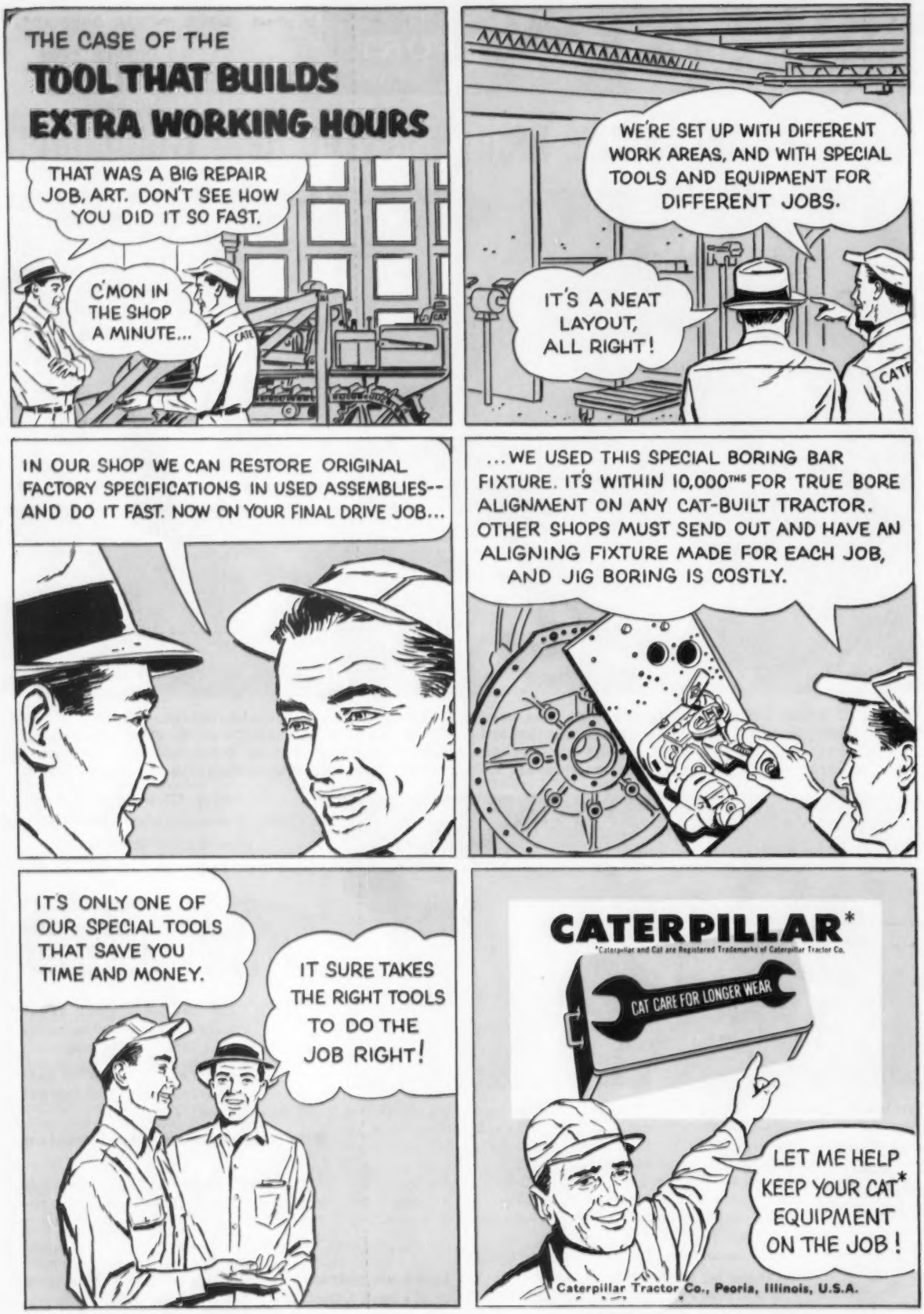
THE CASE OF THE
TOOL THAT BUILDS EXTRA WORKING HOURS
THAT WAS A BIG REPAIR JOB, ART. DON'T SEE HOW YOU DID IT SO FAST.
C'MON IN THE SHOP A MINUTE...
WE'RE SET UP WITH DIFFERENT WORK AREAS, AND WITH SPECIAL TOOLS AND EQUIPMENT FOR DIFFERENT JOBS.
IT'S A NEAT LAYOUT, ALL RIGHT!
IN OUR SHOP WE CAN RESTORE ORIGINAL FACTORY SPECIFICATIONS IN USED ASSEMBLIES--AND DO IT FAST. NOW ON YOUR FINAL DRIVE JOB...
...WE USED THIS SPECIAL BORING BAR FIXTURE. IT'S WITHIN 10,000THS FOR TRUE BORE ALIGNMENT ON ANY CAT-BUILT TRACTOR. OTHER SHOPS MUST SEND OUT AND HAVE AN ALIGNING FIXTURE MADE FOR EACH JOB, AND JIG BORING IS COSTLY.
IT'S ONLY ONE OF OUR SPECIAL TOOLS THAT SAVE YOU TIME AND MONEY.
IT SURE TAKES THE RIGHT TOOLS TO DO THE JOB RIGHT!
CATERPILLAR*
*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.
CAT CARE FOR LONGER WEAR
LET ME HELP KEEP YOUR CAT* EQUIPMENT ON THE JOB!
Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

E&MJ NEW PRODUCTS DIGEST *(Continued)*

For More Details on New Product Items and For Copies of Free Literature Listed Below—Circle the Proper Number on Card. Be Sure to Give Your Name and Address.

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

EXPLORATION AND MINING

HOW GENERAL ELECTRIC'S motive power survey helps you select the right locomotive for your specific haulage needs. 6 pp. **(50)**

CAR PULLERS for pushbutton positioning are described and illustrated in 31-page bulletin released by Jones Machinery Div., Hewitt-Robins. **(51)**

MOTOR GRADER facts, figures and data on Allis-Chalmers 45 motor grader are available in 15-page release. **(52)**

MINE CARS, mine locomotives and car passers are covered in 4-page bulletin that illustrates equipment manufactured by May Tunnel & Mine Equipment **(53)**

TRACTOR OPERATOR'S manuals released by Eimco Corp., describe operation as well as maintenance. Check this number for Tractor-Excavator manual. 24 pp. **(54)**

TRACTOR OPERATOR'S manual. Check this number for Eimco's 4-page booklet on the operation of the Eimco front end loader. **(55)**

OFF-HIGHWAY TRUCK, International Harvester's Payhauler 95 and 65, are subject of 8-page bulletin. **(56)**

TRACTOR SHOVELS with torque converter drive, manufactured by Allis-Chalmers Mfg. Co., are covered in 8-page release. **(40)**

AUXILIARY EQUIPMENT

BELT CONVEYOR IDLERS, Bulletin No. 119, is 8-pp, and is available from C. O. Bartlett & Snow Co. **(41)**

FANS, blowers and exhausters in the Robinson Ventilating Co. line can be examined in 8-page bulletin. **(42)**

HOW COAL MINES are cutting costs, with Gates Rubber Co.'s V-belts, hose and rubber-faced plate, is available from the company. **(43)**

MOTIVE POWER BATTERIES, revised catalog by Exide, discusses important features of Exide-Ironclad batteries used in mine vehicles. Available from Exide Industrial Div., Electric Storage Battery Co. 12 pp. **(61)**

REYNOLDS interleaved strip conductor, used in electro-magnetic coils, is the subject of an 8-page brochure. **(62)**

ARMCO STEEL BUILDINGS feature the Steelox panel method of construction, according to 8-page release. **(63)**

ZIRCONIUM'S CHALLENGE TO CORROSION is the title of an 8-page bulletin prepared and illustrated by Carborundum Metals Co. **(44)**

RYCUT 40, Joseph T. Ryerson & Son, Inc.'s leaded machine tool alloy steel is described in 8 pp. **(65)**

ALUMINUM PIPE for tank and vessel hook-up is the subject of 4-page literature released by Reynolds Aluminum. **(45)**

VANDERLOY, the electrolytic iron, and its applications, are covered in 4-page flyer available from Van der Horst Corp. **(46)**

STAINLESS STEEL TYPE 418 SPECIAL, by Allegheny Ludlum Steel Corp., is brought to your attention in a 4-page release. **(47)**

ALUMINUM ALLOY 417, its chemical composition, properties and uses are, the subject of 4-page bulletin developed by Apex Smelting Co. **(70)**

INDUSTRIAL HOSE AND FITTINGS catalog published by Aeroquip Corp., is 12-pp of facts and details about the company's products. **(71)**

HOW TO DETECT, record and warn of airborne radioactive particles is the thesis of 6-page bulletin available from Nuclear Measurements Corp. **(72)**

TIMELY TIPS ON TRANSFORMER MAINTENANCE is pocket-size, 50 pp, packed with details and made available through Westinghouse Electric Corp. **(72)**

JUNE 1957

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

ELECTRONIC'S—your key to better automatic temperature control—is a 4-page introduction to where and when to consider Barber Coleman Co. electonic temperature control equipment. **(73)**

ENERGY CONTROL equipment catalog by Energy Control Co., Inc. is 30 pp, contains data on all the meters, valves, measuring and controlling instruments available through the company. **(74)**

ELECTROMAGNETIC CONTROL CATALOG is 170 pp, contains full information on automatic transfer switches, remote control switches, magnetically held contactors, relays, solenoids and electric plant controls manufactured by Automatic Switch Co. **(75)**

AUTOMATIC TRANSFER SWITCHES catalog by Automatic Switch Co. is 56 pp and part of the full catalog listed above. Can be obtained separate from full catalog. **(76)**

REMOTE CONTROL SWITCHES is 79 pp and part of Automatic Switch Co.'s full catalog as listed in No. 75 above. Can be obtained separate from full catalog. **(77)**

CONTACTORS catalog by Automatic Switch Co. is 28 pp and part of full catalog listed in 75 above. Can be had separate from full catalog. **(78)**

SOLENOIDS catalog by Automatic Switch Co. is 12 pp and part of full catalog listed as No. 75 above. Can be had separate from full catalog. **(79)**

RELAYS catalog by Automatic Switch Co. is 42 pp and part of full catalog listed as No. 75 above. Can be had separate from full catalog. **(80)**

ELECTRIC PLANT CONTROLS catalog by Automatic Switch Co. is 12 pp and part of full catalog listed as No. 75 above. Can be had separate from full catalog. **(81)**

V-BELT DRIVES bulletin by Allis-Chalmers is 12 pp and describes the use of V-belts for longer belt life. **(82)**

FINGER TIP FACTS ON CLEVELAND WORM GEAR DRIVES is 16 pp, provides useful summary of information on the complete standard line of speed reducers, worm gear sets and special units manufactured by Cleveland Worm & Gear Co. **(83)**

WEATHER-PROTECTED MOTORS in the Allis-Chalmers Mfg. Co. line are described in 6-page release. Motors are rated at from 250 to 900 hp. **(84)**

AIR SAW hooks on to air line and cuts through reciprocating blade motion. According to 4-page brochure, Wright Power Saw & Tool Corp.'s machine has no chain. **(85)**

CONSULTATION, DESIGN AND CONSTRUCTION FOR INDUSTRY is the three-way service offered to the mining industry by O. W. Walvoord, Inc. Four-page brochure will introduce you to the company and its services. **(90)**

KARBATE, impervious graphite for corrosive service, is a National Carbon Co. product. Karbate is described in 4-page bulletin now available. **(91)**

HOW TO SELECT WATER TREATING PROCESS FOR MEDIUM PRESSURE BOILERS is the subject of Cochrane Corp.'s 7-page report to American Society of Mechanical Engineers. **(92)**

HOW TO MAINTAIN THE QUALITY OF PETROLEUM PRODUCTS is the subject of thorough 64-page report by Sales Technical Service Dept., Standard Oil Co. **(93)**

ALEMITE lubricating fittings for every industry and every job, is the subject of Alemite Div., Stewart-Warner Corp.'s 32-page catalog. **(94)**

MILLING AND METALLURGY

FLOTATION, reprinted by American Cyanamid Co. from *Industrial and Engineering Chemistry,* is 4-page review of events in last year. **(48)**

SPECTROCHEMICAL ANALYSIS SOURCES is an illustrated brochure offering details on arc and spark units, stands, attachments and accessories available for both direct-reading and photographic analysis. Available through Jarrel-Ash Co. 23 pp. **(49)**

GYRATORY CRUSHER, Traylor type TC is thoroughly described in Traylor Engineering & Manufacturing Co.'s 40-page bulletin. **(95)**

THERMAL DRYING units on McNally Pittsburg Mfg. Corp. line are illustrated in 20-page bulletin that gives technical data on all types. **(96)**

HANDBOOK OF CRUSHING is title of Pennsylvania Crusher Div., Bath Iron Works' excellent, 40-page book on all types of crushers. **(97)**

APPLICATIONS OF CARBON IN MINING AND METALLURGY is title of 10-page report by Great Lakes Carbon Corp. Featured item is Nerofil, a new filteraid for strong alkaline solutions. **(98)**

CENTRIFUGAL CONCENTRATING pans manufactured by Knapp & Bates Ltd. are described in 4-page brochure now available. **(99)**

PLAIN PRIMACORD

Textile-covered, flexible and resilient. Suitable for surface trunk lines and shallow holes where tensile strength and resistance to abrasion and cutting are not required. Tensile strength 125 lbs. 1000-ft. spool 17 lbs.

REINFORCED PRIMACORD

Textile reinforced, tough, resilient, flexible. Recommended for surface trunk lines and deep holes where normal strength and resistance to abrasion and cutting are needed. Tensile strength 160 lbs. 1000-ft. spool 18 lbs.

PLASTIC WIRE COUNTERED PRIMACORD

Armored with wire and covered with plastic material. Recommended for use in deep, ragged holes or with metal or fibre explosives containers, where strength and resistance to abrasion and cutting are essential. Tensile strength 300 lbs. 1000-ft. spool 33 lbs.

BLASTERS AGREE that thunderstorms, high tension lines, power cables — even two-way radios — can be sources of stray electrical currents . . . and that these can cause premature shots under certain conditions.

The best safeguard against such hazards is to use a detonating agent which is insensitive to stray electrical currents.

In primary blasting, use Primacord as the detonating agent in each hole and also as the trunk lines to connect all holes so that they will fire in proper rotation. The entire blast can be detonated from one point on the trunk line — with fuse and cap or electric blasting cap. This final hook-up is made only when all is in readiness and when it is *safe* to fire.

In secondary blasting, use Detacord to prime each charge and to connect all charges, detonating it in the same way.

If your holes are primed with fuse and cap, connect the fuses with Quarrycord.

For more information, see your explosives supplier or write to

PLASTIC REINFORCED PRIMACORD

Covered with tough plastic material, not affected by high Summer heat or Winter cold. Waterproof—resistant to acids commonly encountered. Use for extremely deep holes, river crossings, field shots that must stand for long periods of time and in other wet conditions. Tensile strength 275 lbs. 1000-ft. spool 22 lbs.

THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut . Since 1836

Primacord and Detacord Detonating Fuse, Ignitacord,® Quarrycord, Safety Fuse, Pyrotechnical Devices and Blasting Accessories

DETACORD

Smaller (and less powerful) than Primacord. Core of PETN is textile-reinforced and wax finished. Identified by light brown surface with cross windings of red yarn forming an "X" pattern. Resilient, flexible. An economical detonating fuse for use in secondary blasting, long hole underground blasting and pipe-line ditching. *Not* recommended for primary blasting. Tensile strength 100 lbs. 500-ft spool weighs 8 lbs.; 1000-ft spool weighs 16 lbs.

QUARRYCORD

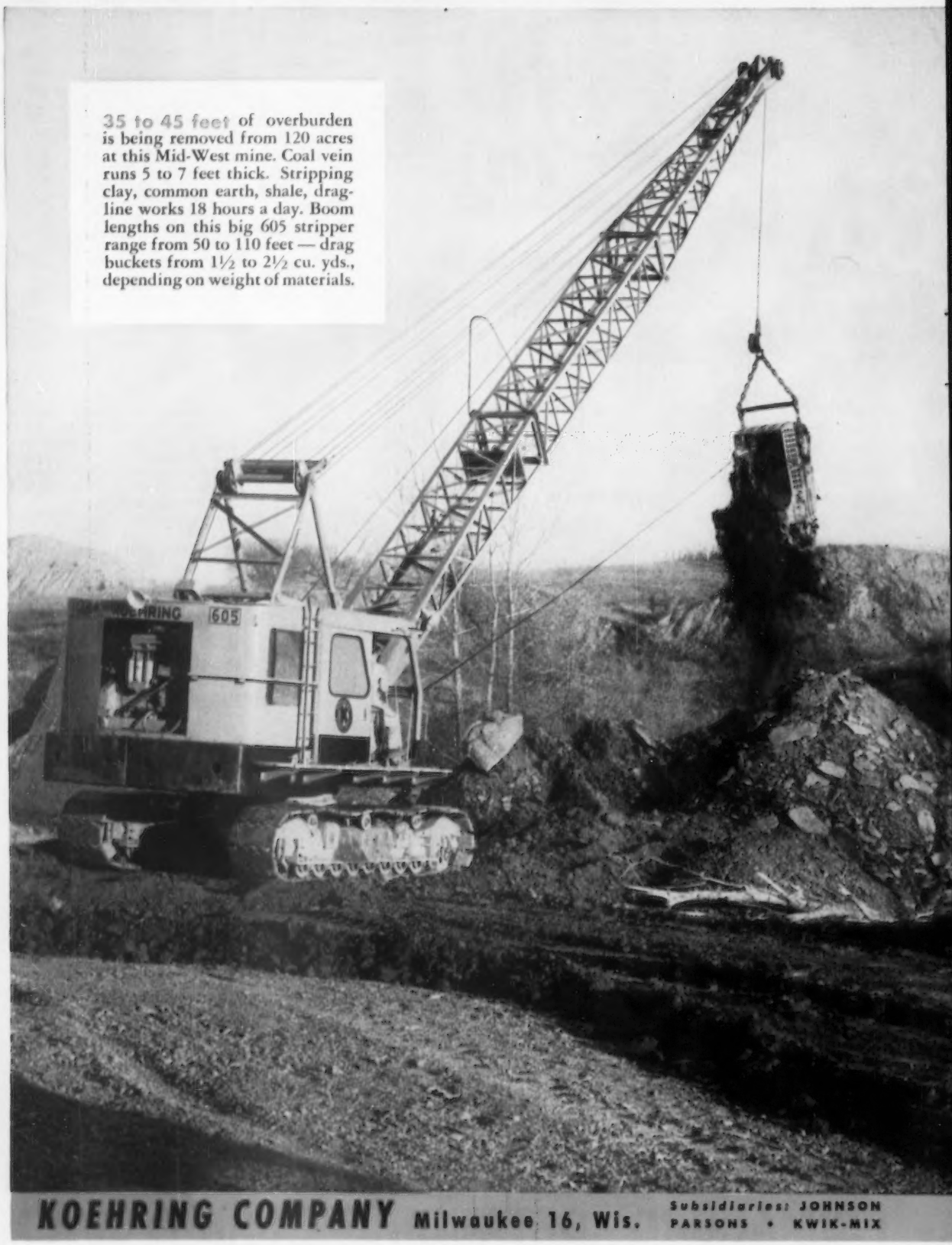
Used to connect and ignite safety fuse in secondary blasting. Burns progressively with an external flame at the zone of burning — about one foot per second. Flexible — not affected by stray currents. 500 ft. spools. Quarrycord Connectors — 100 in a box.

USE

P-4

PRIMACORD® · DETACORD® · QUARRYCORD®

KOEHRING WORK CAPACITY *in action . . .*



35 to 45 feet of overburden is being removed from 120 acres at this Mid-West mine. Coal vein runs 5 to 7 feet thick. Stripping clay, common earth, shale, dragline works 18 hours a day. Boom lengths on this big 605 stripper range from 50 to 110 feet — drag buckets from 1½ to 2½ cu. yds., depending on weight of materials.

KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON PARSONS • KWIK-MIX

Meet the 405 — new heavy-duty leader in the 1-yard class. Operators like its ease of control, big power clutch, automatic traction brakes, and simple 2-shaft design of upper machinery. *You'll* like its big work capacity with all attachments: 1-yard shovel or hoe, 1 to 1½-yard clam or dragline, 20-ton crane.

Pan-handler — In an Eastern quarry, slabs of sandstone are palletized on pans for quick pick-up, and loaded on trucks. Pans weigh an average of 3½ tons — an easy lift for the Koehring 205 truck crane. Constantly moving to various piles around the quarry, it easily loads 24 pans an hour, according to quarry foreman. With this mobile 205 crane they are equipped to handle loads up to 15 tons.

At rail siding, 305 clamshell crane speeds transfer of material from gondola cars to trucks. Its fast swing and wide work radius pay off on any material-handling. This heavy-duty 305 is another in a modern, new series of Koehring extra-capacity excavators and cranes. Look them over. They're all listed in accompanying chart.

Here are some figures that will interest you:

KOEHRING MODEL	SIZE DIPPER	LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load.)	
205 CRAWLER	½-Yd.	20,000 lbs.	at 10-foot radius
205 ON RUBBER	½-Yd.	30,000 lbs. 13,700 lbs.	at 12-foot radius at 20-foot radius
305 CRAWLER	¾-Yd.	30,000 lbs.	at 12-foot radius
305 ON RUBBER	¾-Yd.	50,000 lbs. 15,800 lbs.	at 10-foot radius at 30-foot radius
405 CRAWLER	1-Yd.	40,000 lbs.	at 12-foot radius
605 CRAWLER	1½-Yds.	72,300 lbs.	at 12-foot radius
1205 CRAWLER	3-Yds.	190,000 lbs.	at 13-foot radius

Want more information? Call Koehring distributor today.

Users Say R/M BELTS AND HOSE

R/M Poly-V® Drive
More Power—Less Space!

Major causes of drive trouble are engineered *out* of R/M's patented new Poly-V* Drive. A single, endless V-ribbed belt running on specially designed sheaves gives Poly-V *twice* the tractive surface. Poly-V can deliver up to 50% *more* power in the *same* space as V-belt drives—*equal* power in 2/3 the space! This means *narrower* sheaves . . . *less* shaft overhang . . . *less* drive weight . . . *less* bearing load. Belt speed ratio and belt position remain constant under *all* loads to run smoother, cooler—with less wear on belt *and* sheaves!

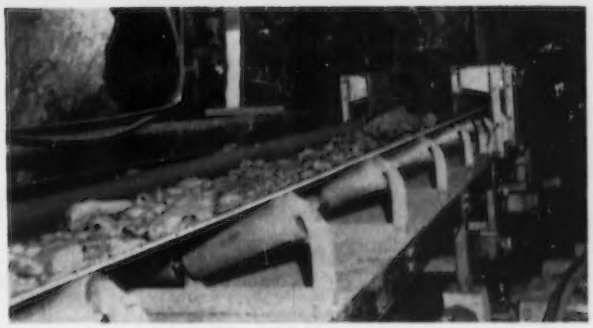
Poly-V eliminates multiple-belt "length matching" problems, too. And just *two* cross sections of Poly-V Belt meet *every* requirement for heavy duty power transmission. An R/M representative will show you other features of Poly-V Drive that add up to longer, trouble-free service on your equipment.

Write for Bulletin # 6638

*Poly-V is a registered Raybestos-Manhattan Trademark.

For the "Smoothest Running V-Belts Made," Specify CONDOR and R/M SUPER-POWER V-BELTS

Give You "More Use per Dollar"



HOMOFLEX HOSE
Reduces Hose Costs!

Because R/M engineering *increases* hose life! Homoflex Hose is light, yet strong . . . and "flexible as a rope." Mandrel-made with *no* pre-set twist . . . coils and uncoils in *any* direction—*without* kinking—without causing internal strain that can lead to hose rupture and failure. Homogeneous tube-to-cover bond is virtually inseparable. Uniform inside and outside diameters assure easy coupling . . . fuller, faster flow! Homoflex Hose does a *better* job and *lasts longer* . . . gives you "More Use per Dollar."

Write for Bulletin #6879

RAY-MAN CONVEYOR BELT
Lasts Longer on Tough Hauls

Cushioned strength members . . . *double* compensation, top and bottom plies, relieves stress rounding pulleys. Strength *plus* flexibility permits peak loads, with natural troughing. Ray-Man requires no breaker strip . . . is practically rip-proof . . . *holds* fasteners . . . is mildew-proof and moisture resistant. Exclusive "XDC" Cover increases protection against wear, tears, cuts and abrasion. Check "More Use per Dollar" features of other R/M conveyor belts, too . . . Homocord for unusually abusive shock loading . . . R/M Tension Master for long lifts, high tensions.

Write for Bulletin #6915

RM-714

BELTS • HOSE • ROLL COVERING • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

2,300,000 pounds ship-to-shore in one hour!

Westinghouse-equipped ore unloaders set new highs in speed and dependability for McLouth Steel

Power. Durability. Precision. These were the requirements for the motors and controls to operate these two 547-foot ore bridges for McLouth Steel. Westinghouse supplied the solution with rugged MC mill motors and the newest developments in automatic controls—Magamp* and Rototrol®.

In just 41 seconds, these ore bridges run a complete cycle—digging, hoisting, trolleying, dumping, rehoisting and back again for another 27,000-pound scoop.

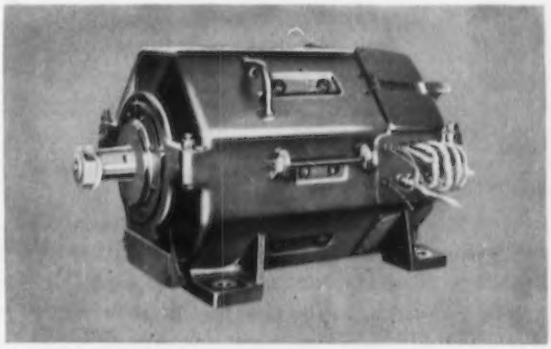
It will pay you to investigate the facts that give such outstanding results as these when you are considering motors, drives and controls. Get the details from your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, 3 Gateway Center, P.O. Box 868, Pittsburgh 30, Pennsylvania.

*Trade-Mark
J-21957

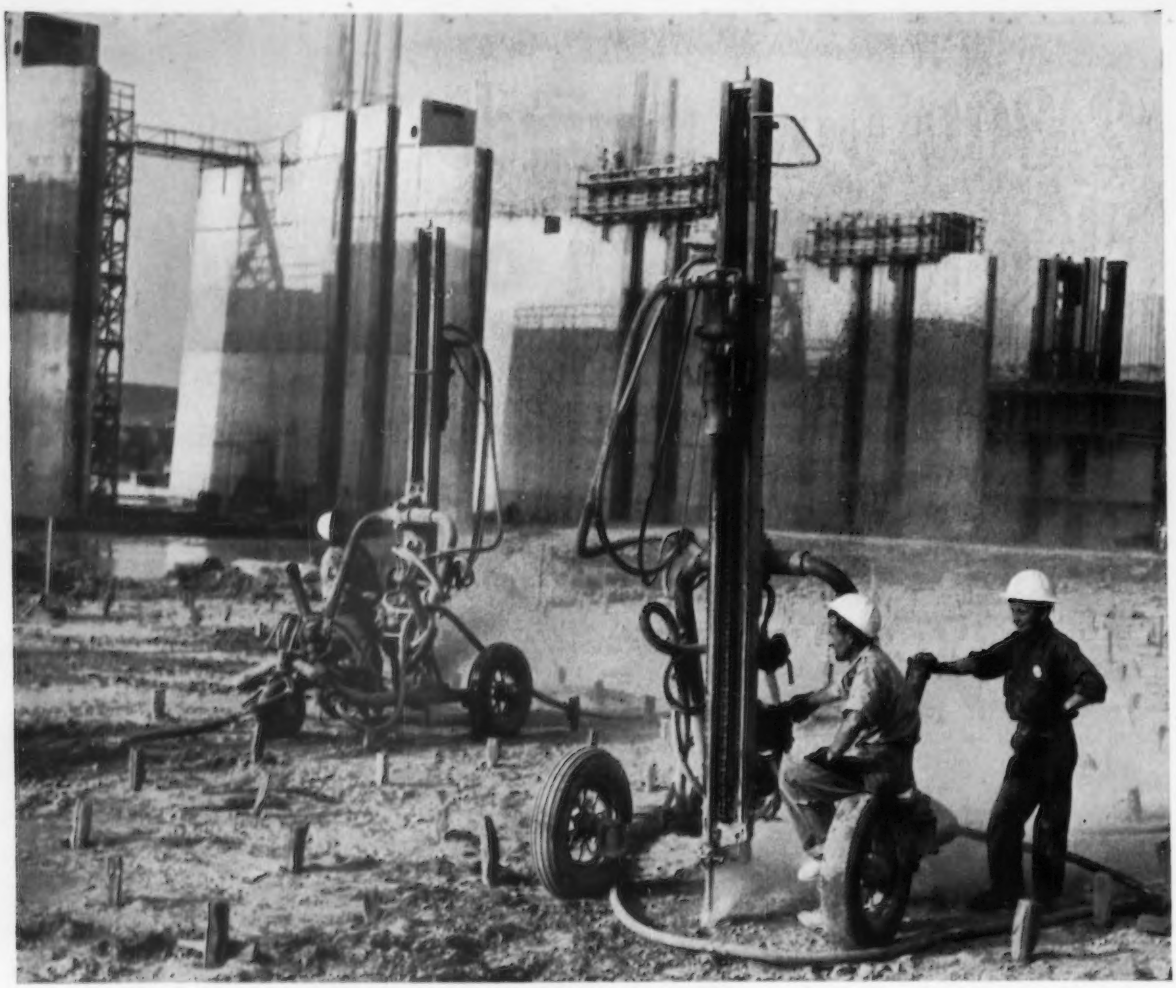
YOU CAN BE SURE...IF IT'S

Westinghouse

These two new ore bridges can unload all size boats by means of an adjustable "apron" which can be raised high enough to allow the mast of any vessel to pass underneath. Dependable Westinghouse hold-and-close motors carry the load on this modern installation.



Rated at 187½ hp, 230 v, 460 rpm, this 616 Series mill motor gives the kind of outstanding performance to meet today's tougher, faster jobs. Westinghouse engineers are ready to work with you to give you the best motors and controls for your needs.



Bethlehem Hollow bites into dolomite at Iroquois Dam, on St. Lawrence Seaway. The dam, for Power Authority of State of New York, is scheduled for completion early in 1958. *Joint Venture Contractors:* Peter Kiewit Sons' Co., Omaha; Arthur A. Johnson Corp., New York; Al Johnson Construction Co., Minneapolis.

Moving 250,000 cu yd on the St. Lawrence

One of the major undertakings of the St. Lawrence Power Project was the removal of 250,000 cu yd of hard dolomite at the site of Iroquois Dam, near Waddington, N. Y. Most of the blast holes, which were up to 14 ft in depth, were made with wagon drills, equipped with 1-in. round Bethlehem Hollow Drill Steel.

Iroquois Dam, a 2500-ft control dam, is designed to control the water elevation of Lake Ontario, which has been controlled upstream from this structure by a natural rock weir. The dam will be a buttressed gravity concrete structure. It will be 60 ft high from foundation to roadway deck, and will contain 32 gate-controlled sluiceway openings. The vertical lift gates are to measure 48 ft by 52 ft.

Wherever rock removal is called for, you can count on economical drilling with Bethlehem Hollow Drill Steel. This is because Bethlehem Hollow is rolled from a tough grade of fatigue-resisting steel. It has a uniformly centered hole, and its wide quenching range makes it easy to heat-treat for the proper balance of toughness and wear-resistance. It also provides long-wearing threads and strong shanks.

Bethlehem Hollow is stocked in Carbon and Ultra-Alloy grades in rounds, hexagons and quarter-octagons. It is furnished in lengths of from 18 to 27 ft, and longer. Specify Bethlehem Hollow for your next rock job.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

Solving Slime Problem with AERO® Depressant 633 Substantially Improves Recovery

The value of AERO Depressant 633 as a gangue slime dispersant and depressant has again been demonstrated at an African mine treating a gold ore containing about 7 dwt. Au per ton in quartz gangue.

The gold is recovered here by a combination of straking, flotation and cyanidation of roasted flotation concentrates.

At this property about 70% of the gold is free and is recovered on strakes. Recently, narrowing veins increased the proportion of wall rock in the plant feed, raising micron-sized graphitic slime content to about 10% of the feed weight. Slimes had been removed from strake tailings with cyclones followed by hydroclassification in a thickener. Increasingly high slime content of flotation concentrates reduced the ratio of concentration, caused balling in the roaster and incomplete roasting; and overloaded the cyanidation plant.

Adding AERO Depressant 633 at the rate of 0.4 pounds per long ton decreased residue values by 24.4% and increased concentrate grade by 8.5%, with only one recleaning instead of two. Strake tailings now go directly to flotation without cyclone desliming. Flotation concentrates are again being roasted and cyanided without difficulty. Other reagents used include 0.07 pounds per long ton of AERO Xanthates 301 and 303; 0.12 pounds of copper sulfate and 0.08 pounds of frother.

Perhaps AERO Depressant 610, 615, 620 or 633 would be of help in your flotation operation. These products are all excellent controllers of carbonaceous and micaceous gangue. We will be pleased to send you samples for testing.

AMERICAN CYANAMID COMPANY

MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

NORTH AMERICAN CYANAMID LIMITED
160 Bloor Street East,
Toronto 1, Ontario, Canada

CYANAMID DE MEXICO, S. A.
Apartado No. 26012, Mexico 12, D. F., Mexico

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377 Little Collins St.,
Melbourne C. 1, Australia

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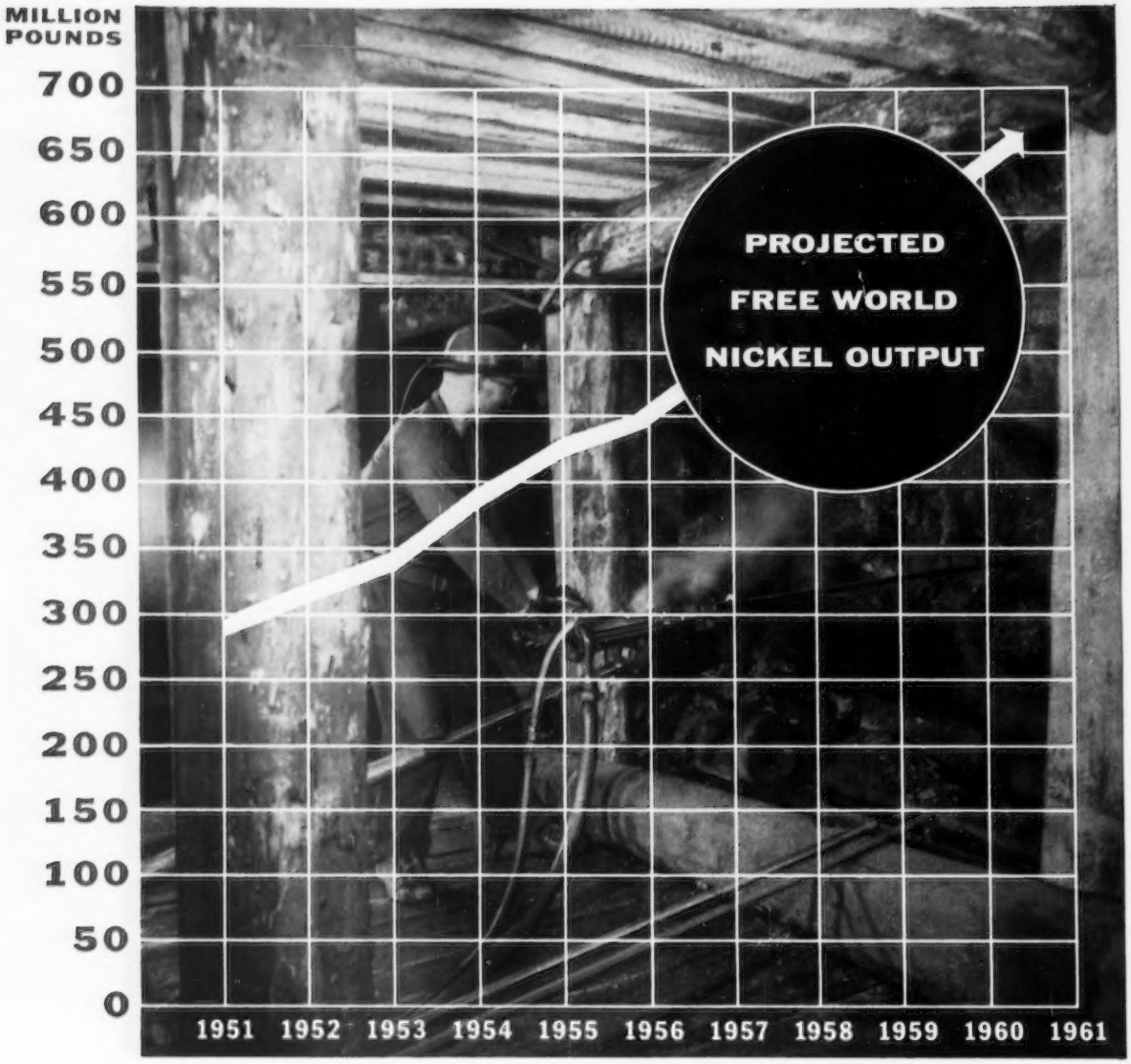

Another 50% advance in nickel industry's production capacity

Paced by Inco-Canada's new developments in Manitoba, producers put 1961 Free World nickel output at 650-675 million pounds a year—up 130% over 1951

In 1951, the nickel industry of the *Free World* produced about 290 million pounds of nickel.

Last year, the over-all output of the industry set a new record high of 450 million pounds.

This was an expansion of more than 50% in five years: a substantial production boost that indeed benefited industry, but only after vital defense and government stockpile needs were given preference.

New Inco-Canada developments help set new goals

Right now Inco-Canada, with years of exploration behind the project, is pushing construction at its new Manitoba mines: developing in the far North a new, big-tonnage nickel-producing area.

In Ontario, at the same time, Inco-Canada is continuing to expand its Sudbury capacity.

In 1961, this should lift Inco-Canada's nickel output to 385 million pounds a year. A hundred million more than in 1956!

With the steadily increasing capacity of all *Free World* producers, in the next four years nickel production should be lifted to the all-time high of 650-675 million pounds a year.

With 1961 capacity anticipated at more than twice what it was in 1951—and with continuing exploration—nickel users are assured of more nickel in their future.

The International Nickel Company, Inc., New York 5, N.Y.

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INCO **International Nickel**

The International Nickel Company, Inc., is the U. S. affiliate of The International Nickel Company of Canada, Limited (Inco-Canada)—producer of Inco Nickel, Copper, Cobalt, Iron Ore, Tellurium, Selenium and Platinum, Palladium and Other Precious Metals

Save With Eimcos

In a wide variety of mining systems, where profit depends on high tonnage, low cost mucking... there are IMPORTANT REASONS why Eimco 630's get the job done better!

The 630 has a 6,000 lb. digging force behind its ½ cu. yd. bucket for fast digging. Overhead discharge eliminates time-killing turns and maneuvers. With experienced operator and good car availability, it is not unusual to expect production up to 4 tons per minute.

With his left hand the operator controls independent track movement... with his right, bucket motion. He can crowd the pile from any angle and manipulate the bucket simultaneously. He can twist, turn, get out of tight places at full speed under full load. Moving the 630 from place to place is easy and fast.

Rugged construction and exclusive protective features insure against costly mechanical delays.

These among other factors make the Eimco 630 Excavator your best investment per cubic yard capacity. Write for full details or arrange to have an Eimco engineer visit you!

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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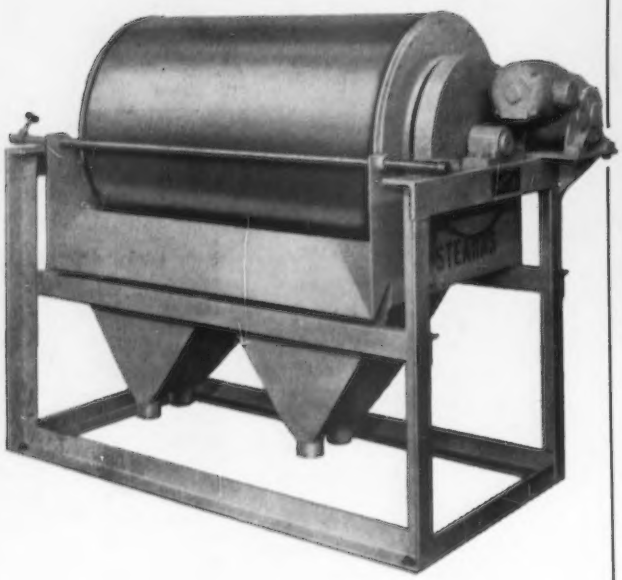
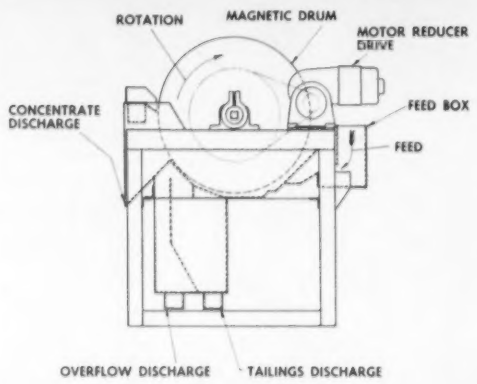
EIMCO ®

B-261

Combine high-speed recovery with positive selectivity . . .



Specify STEARNS Magnetic Drum Separator



For cobbing or roughing of iron-bearing ores in big volume, rely on the Stearns WPD—a wet-type magnetic drum separator that offers truly outstanding efficiency. Here is a highly selective unit that can handle feeds up to 600 gpm of slurry containing particles from ⅜ in. down to fines.

The high recovery rate and low operating cost of the WPD assure speed and economy in performance not possible with other concentration equipment.

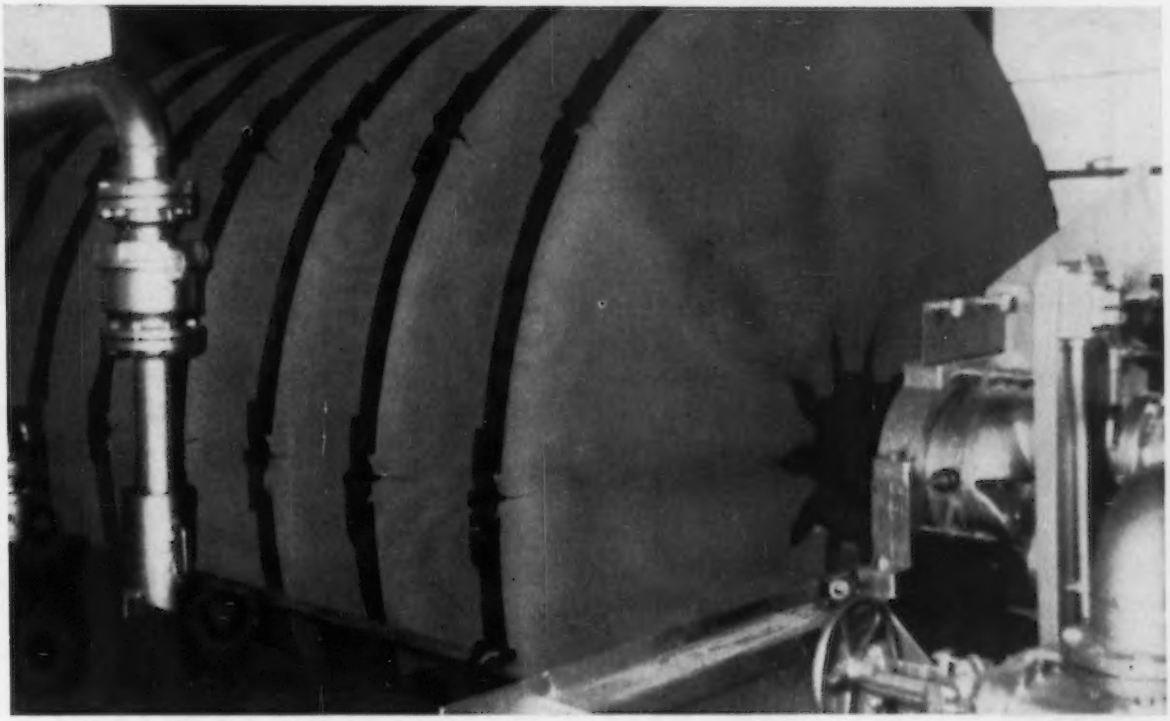
The powerful and dependable permanent magnet assembly produces a deep magnetic field with ideal flux distribution across the surface of the rotating drum. Positive and selective transportation of magnetic material produces a clean concentrate at the discharge.

Operation and maintenance require no special skills. One man can easily handle a multiple installation of Stearns separators, keep production at a high level with a minimum of attention.

The Stearns WPD magnetic drum separator is available in five drum widths from 15 in. to 75. in. Whatever your separation, purification or concentration problems, your Stearns representative will be pleased to help you select a separator that will give efficient performance and long service at low cost. See him soon, or write for Bulletin 2011-D.

STEARNS MAGNETIC PRODUCTS

635 SOUTH 28TH STREET • MILWAUKEE 46, WISCONSIN



NEW GILSONITE PROCESS EMPLOYS EIMCO AGIDISC FILTER

A transport system unique to the Gilsonite Industry was introduced recently when Gilsonite began flowing over mountainous terrain thru a 6" pipeline . . running 72 miles from **American Gilsonite's** Bonanza, Utah mine to a high process distillation plant at Gilsonite, Colo.

The mineral is crushed, suspended in water and pumped thru the line at a rate approximating 3 mph. Concentrate is fed into the station thru an 8' 10" x 10 disc **Eimco Agidisc Filter . .** the **only** filter employed in a separation process involving a Gilsonite slurry.

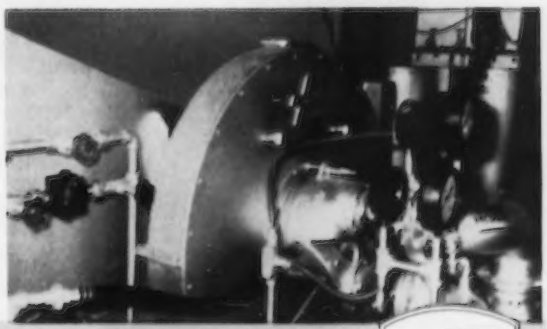
American Gilsonite, after years of research, decided this was a feasible transport method. It is anticipated that the line will deliver 260,000 tons of Gilsonite each year.

The **Eimco Agidisc** is regulative equipment for the plant, controlled entirely by automation. Methods employed will produce carbons extremely high in quality.

Teamwork between engineering personnel at **American Gilsonite** and **Eimco** resulted in the elaborate, highly practical piping system seen in the photos. **Eimco Hy-Flow Design** (lower right) is provided throughout the filter to permit "straight-through" flow of filtrate and air. Filtrate load is divided between two valves (one at each end of the center barrel) to further increase capacity.

These features, plus properly directed agitation and rugged steel construction, promote high velocity . . uniform particle suspension and cake formation . . low cake moisture content . . excellent filtrate clarity . long, trouble free service.

Write today for full information on the Eimco Agidisc Filter.



THE EIMCO CORPORATION

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B-263

TP PAN TYPE TRAILER

BP PAN TYPE TRUCK BODY

TP TRAILER (GOOSENECK)

announcing a NEW cooperative sales policy*

EASTON off-highway trailers and truck bodies may now be purchased through truck manufacturers and their recognized contract dealers.

TD DROP DOOR TRAILER

BD TRUCK BODY

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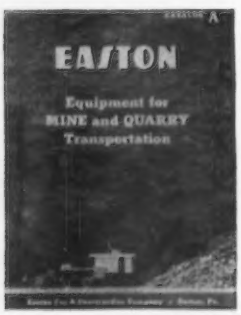

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This new sales policy applies throughout the United States and Canada. For export sales consult our New York Office: 50 Church Street, New York 7, N. Y.

B-1076

EASTON CAR & CONSTRUCTION COMPANY, EASTON, PA.

Quoting H.E. (ACE) GREEN, tunnel superintendent: "EIMCO 105 Excavators with heft to dig fast and overhead discharge, are the fastest tunnel loaders I've worked with."

The project was organized on a two cycle, 24 hour timetable with two drill and two mucking shifts. Here, Eimco 105 and dump wagons wait out blasting operations.

Quoting J. E. R. WOOD, president, NORTHWOOD INC.: "The fact that we have four EIMCO 105's is proof we're sure they promote high tonnage production."

WILKES-BARRE, PA. - Operator JOSEPH WEIKEL of Pottsville, Pa., prepares to unleash the EIMCO 105 Excavator's tremendous digging power during Bear Creek Diversion Tunnel operations. His comment: "It's the digginest machine I've operated."

The 19' circular bore was blasted through 1,150 feet of rock by NORTHWOOD INC. U.S. Army engineers directed the project.

EIMCO 105 SAVES TIME MUCKING FOR TUNNEL DRIVERS

"SAVES MINUTES EVERY CYCLE." That's how AL AITKEN, V-P, NORTHWOOD INC., supervisor of Bear Creek Tunnel operations, describes the EIMCO 105 Excavator's performance.

Part of the $18 million Bear Creek Reservoir Project, this tunnel will be outlet channel for the 234' high earthen dam. NORTHWOOD, with main offices in Vancouver B.C., is one of the Continent's active tunnel drivers.

Equipped with 1½ yard excavating bucket, the EIMCO 105 loaded 100 cubic yards of material into dump wagons after each blast. Between 200 and 400 lbs. of dynamite, used in a 48-hole drilling and shooting pattern (usually fired in 10 stages of delay) produced an average advance of 7½' per round . . . 15' per day.

The tunnel was drilled to a bore size of 19' in the rough using 6 jack legs on a single deck jumbo. Concrete lining will reduce inside diameter to 16'. Six inch I-beam supports wedged tightly with wooden blocking are spaced every 4'. The EIMCO 105 now is taking up a 4' bottom left to provide flat surface for trucks.

NORTHWOOD'S high appraisal of the EIMCO 105 is duplicated often in field reports from tunnel projects and mines throughout the world.

With any attachment- - Excavator, Front-End Loader, Bulldozer, Fork Lift, and others - - EIMCO 105 owners get superior design . . performance speed and power . . . operating ease and economy . . . versatile maneuverability . . . dependable service under hard usage.

Plan now to learn why you can shade your next bid and still keep the profit by figuring earthmoving costs around the EIMCO 105.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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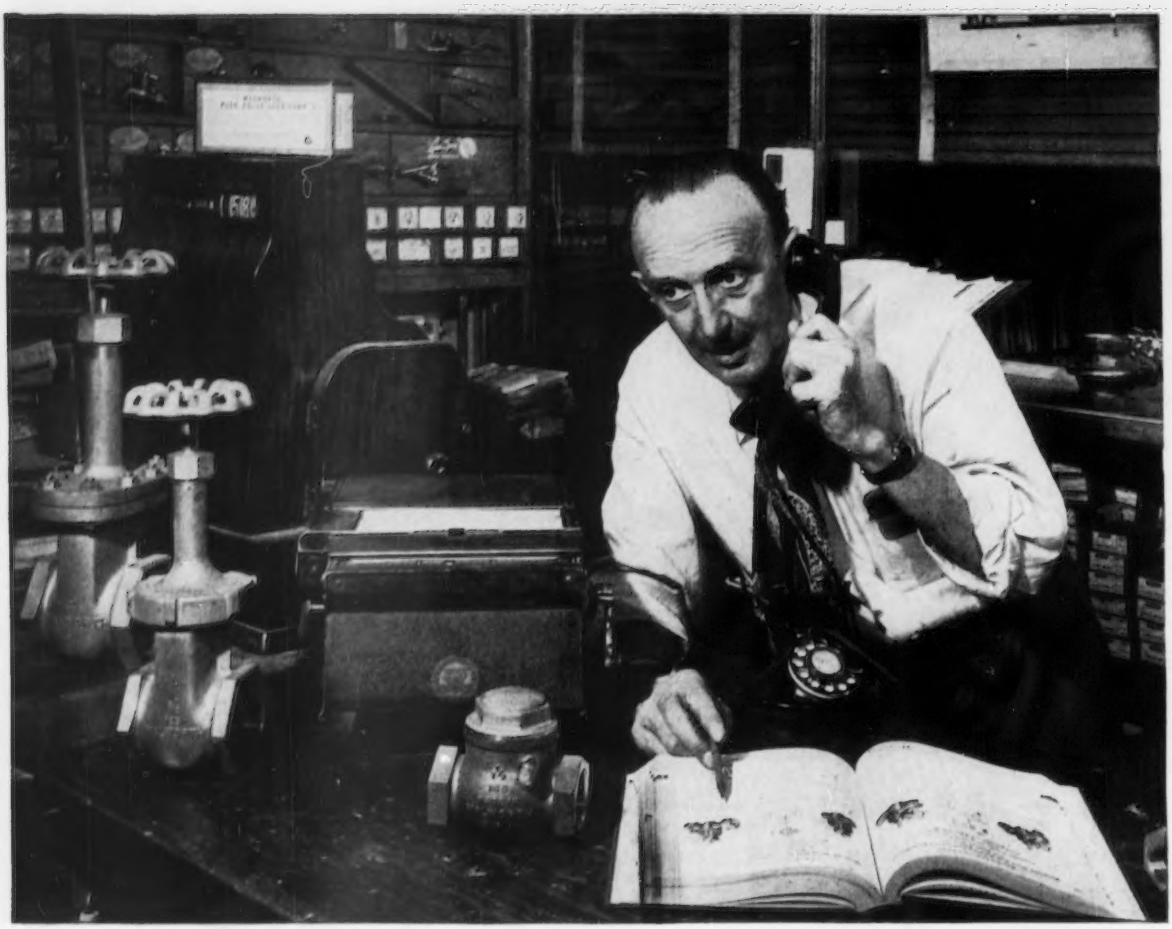
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B 265



*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical – emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth – a complete line manufacturer.

There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

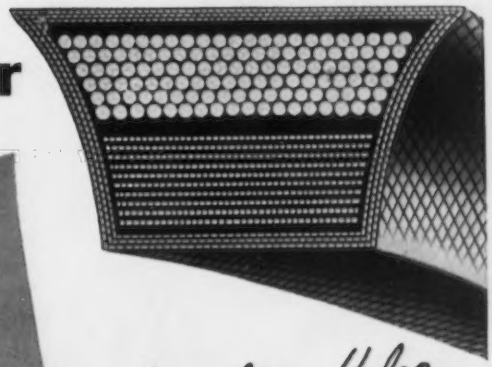
valves . . . pipe fittings . . . pipe wrenches

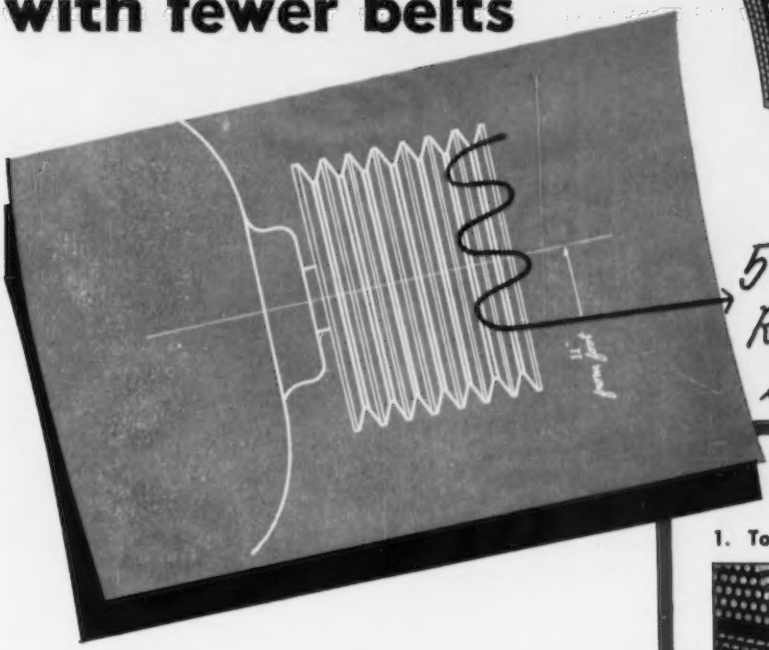
60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

Cut sheave width and weight...

get same horsepower with fewer belts





5 Gates Super Vulco Ropes do the work of 7 standard V-belts

Where space is limited and weight a factor, design your drive with this important fact in mind:

5 Gates Super Vulco Ropes do the work of 7 standard V-belts

That's because a Gates Super Vulco Rope has 40% more horsepower capacity — delivers more horsepower per dollar invested than any standard V-belt drive. Sheaves with fewer grooves cost less . . . weigh less . . . take less room. Drive design is invariably improved.

A wealth of drive data is quickly available to you. Simply call your nearby Gates distributor for a Gates V-belt specialist. Stocks carried in industrial centers around the world.

The Gates Rubber Company
Denver, Colorado

GATES Distributors are in the Yellow Pages

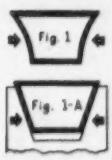
The Mark of Gates Specialized Research

No other V-Belt has ALL these advantages

1. **Tough, resilient Tensile Cords**

Super strong resilient tensile cords provide 40% greater horsepower capacity . . . easily absorb heavy shock loads . . . reduce number of belts required . . . save weight and space.

2. **Concave Sidewalls (U.S. Pat. 1813698)**



Concave sides (Fig. 1) increase belt life. As belt bends, concave sidewalls become straight, making uniform contact with sheave groove (Fig. 1-A). Uniform contact means less wear on sides of belt . . . far longer belt life.

3. **Flex-Weave Cover (U.S. Pat. 2519590)**

A Gates exclusive: provides greater flexibility with far less stress on fabric. Cover wears longer . . . increases belt life . . . more power available to driven machine.

4. **High Electrical Conductivity**

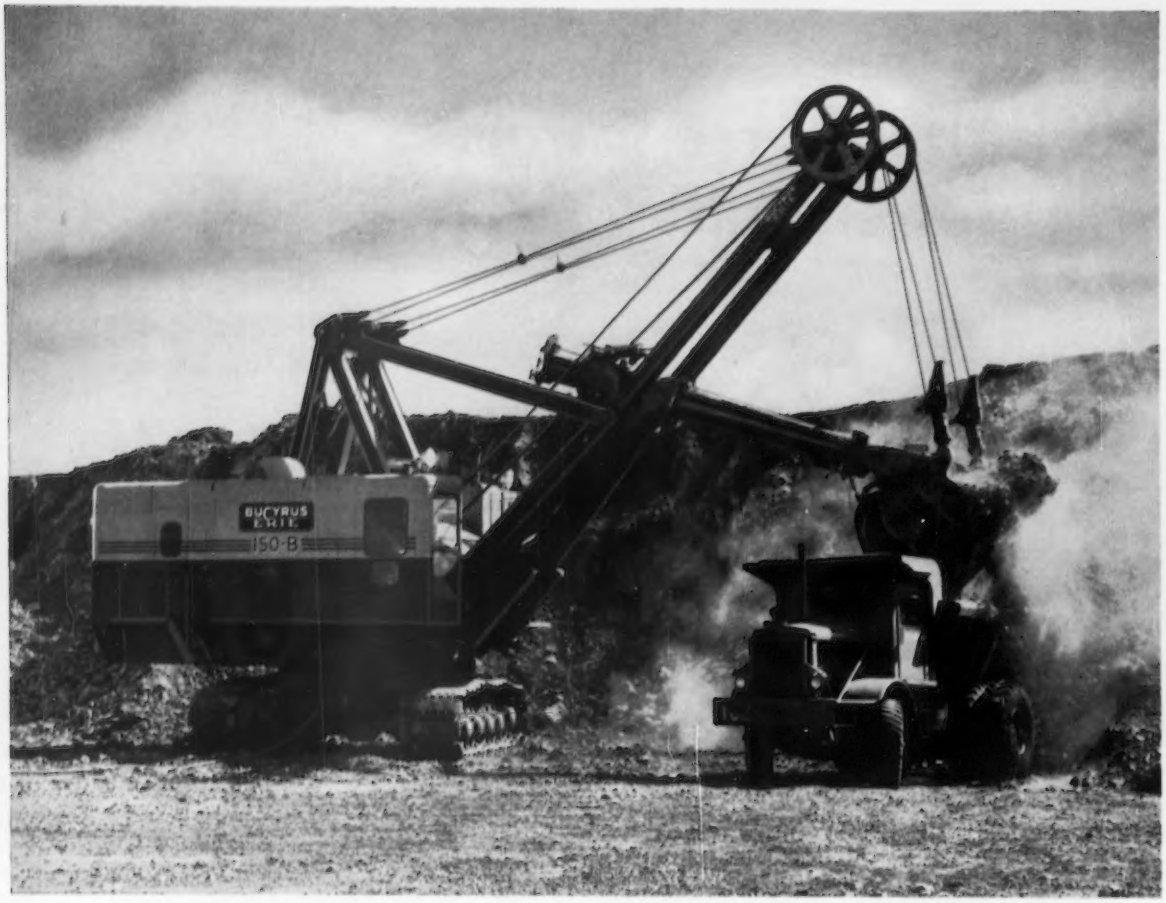
Built into Gates Super Vulco Ropes for safer drives (in explosive atmospheres).

5. **Oil, Heat, Weather Resistant**

Special rubber compounds make Super Vulco Ropes highly resistant to heat, oil, and prolonged exposure to weather.

TPA 248

Gates Super Vulco Rope Drives



This Bucyrus-Erie 6-yd. 150-B is shown working in a California iron mine.

In California . . . and the World Over

Bucyrus-Erie Electric Shovels Help Keep a Ceiling on Mining Costs

Stripping stubborn overburden, loading abrasive iron ore—*any* tough mining job is taken in stride by Bucyrus-Erie electric shovels. Most important, they work with the dependability and economy necessary to keep a ceiling on mining costs.

The modern design that makes the outstanding performance of Bucyrus-Erie electric shovels possible begins at the front end with exclusive two-section boom. This design provides plenty of strength without excess weight, reduces wear on main machinery and speeds work cycles. Ward Leonard electric control provides fast acceleration and deceleration for high-speed coordinated operation. There is extra torque and ample power when it is needed most.

These and other important features combine to make Bucyrus-Erie electric shovels outstanding in their ability to put a ceiling on mining costs the world over. 146157

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110-B 4½-cu. yd.
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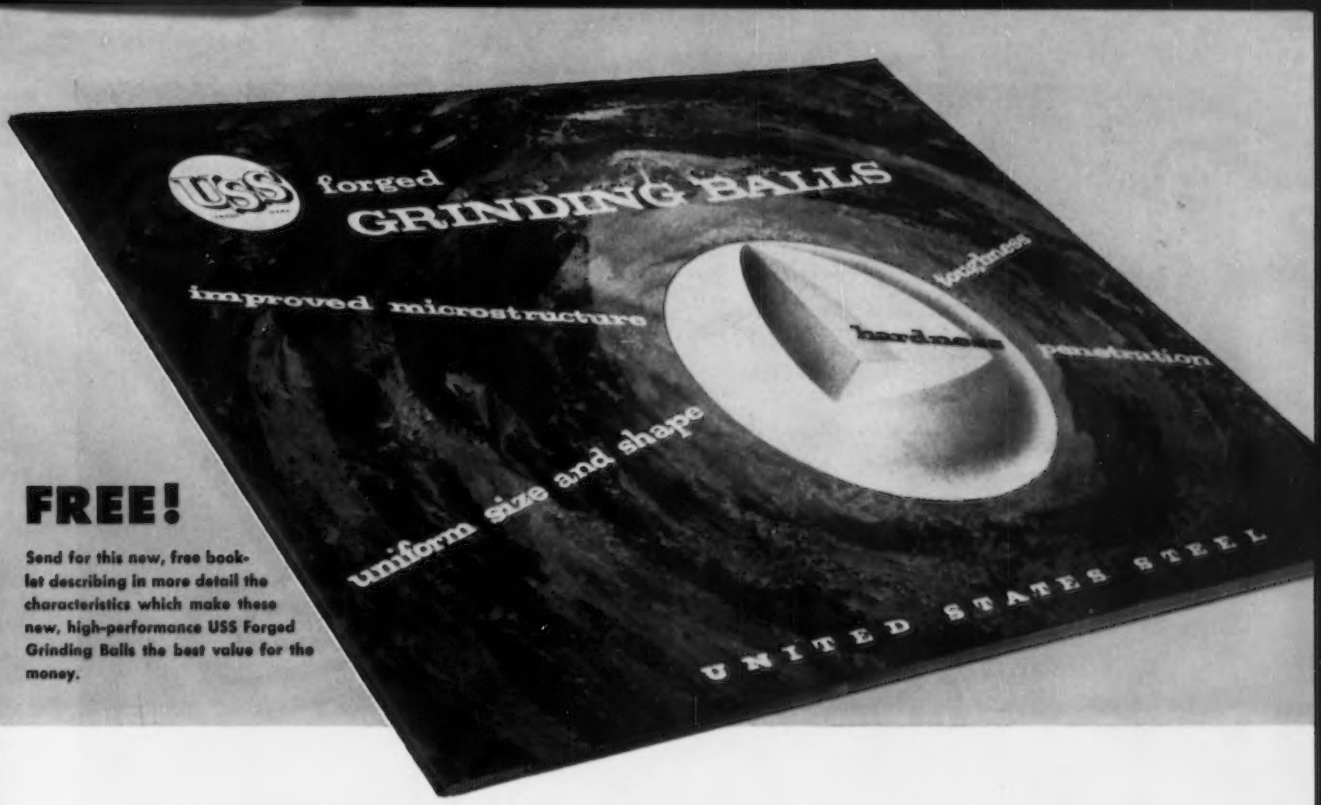

FREE!

Send for this new, free booklet describing in more detail the characteristics which make these new, high-performance USS Forged Grinding Balls the best value for the money.

United States Steel announces

new, high-performance Forged Grinding Balls

made of either Carbon-Manganese or Alloy Steel

New equipment and new standards of quality control make the new USS Forged Steel Grinding Balls the very best you can buy.

The chemical composition and heat treatment of these new balls were designed to obtain a high level of hardness combined with sufficient toughness to minimize breakage. This combination assures you of excellent ball performance.

USS Forged Carbon-Manganese Grinding Balls are designed to withstand the rugged treatment found in most mills. USS Alloy Grinding Balls were developed for use in unusually severe operating conditions. Both types are available in the same sizes: ¾", ⅞", 1", 1¼", 1½", 2", 2½", 3", 3½", 4", 5".

USS Forged Grinding Balls

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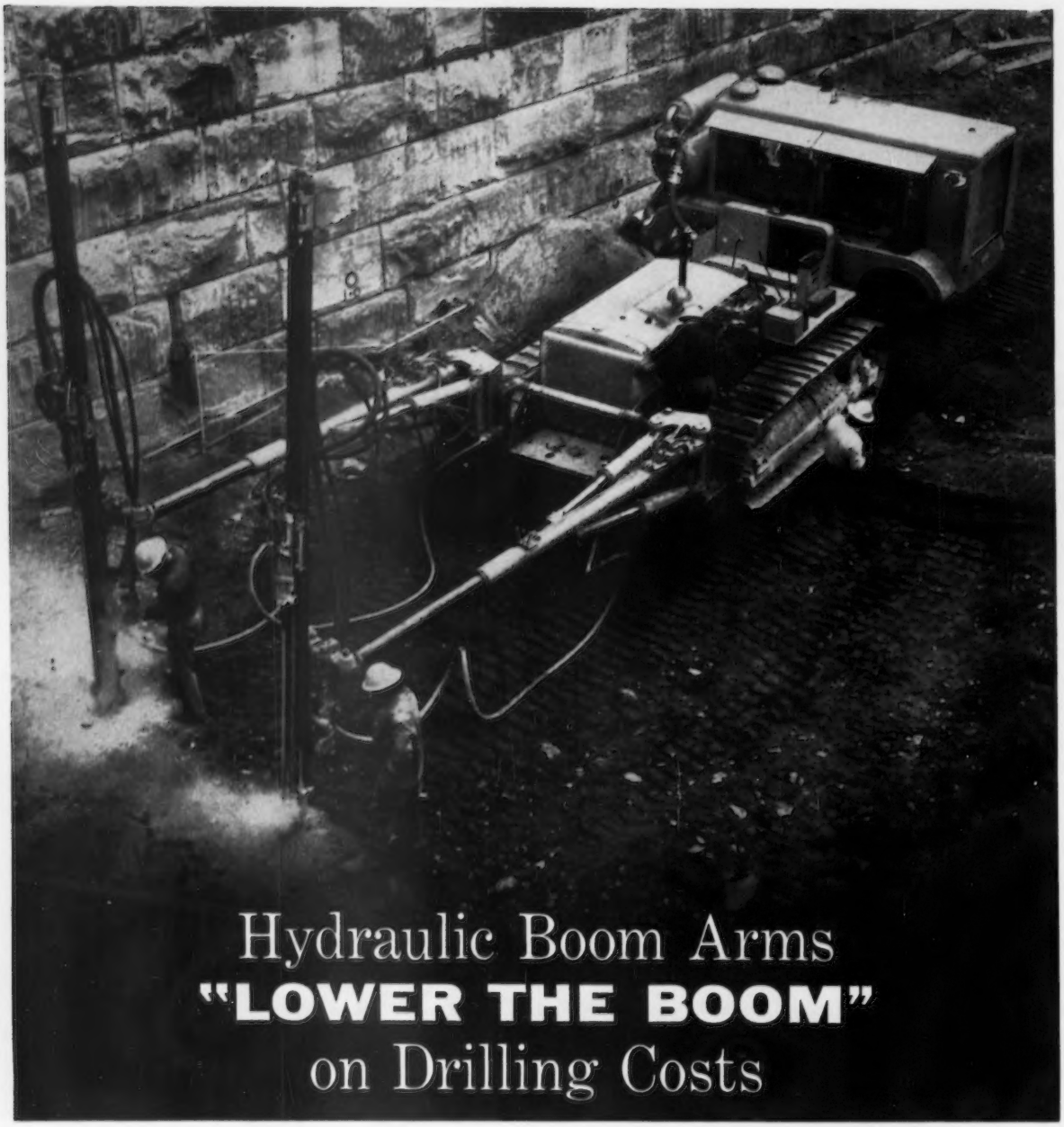


Hydraulic Boom Arms "LOWER THE BOOM" on Drilling Costs

H-Booms have extra-capacity, double-acting hydraulic cylinders that retract and extend, swing or elevate in a hurry—yet pressures are moderately rated. There's no creeping or drifting! Boom can be extended 6 feet . . . that's an extra foot of length to afford better spacing of holes and greater area coverage without moving the rig.

Heavy-duty, Chicago Pneumatic H-Booms can be easily mounted on mine car, track or rubber-tired jumbos. It's a highly productive drilling unit when used on your old tractor. Write for more detailed information. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Your "Cost" Dollars Come Back QUICKER...

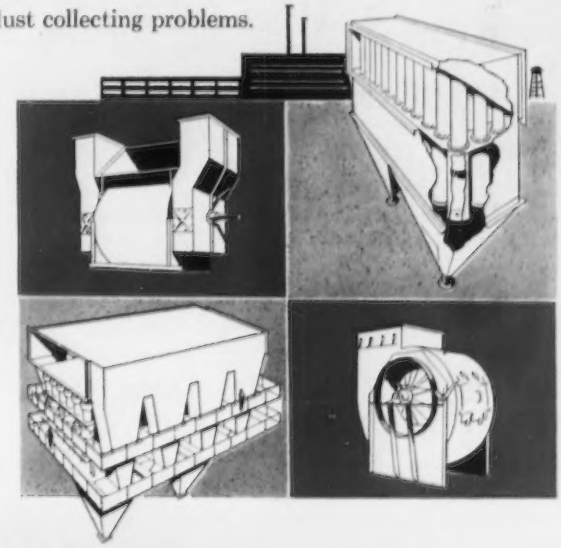
with WHIRLEX dust collecting equipment!

If you are concerned with nuisance elimination . . . or with the recovery of process material . . . WHIRLEX can help you. Our research laboratory, engineering and manufacturing facilities are *totally set up* and especially experienced to provide "dollar-saving" solutions to the most perplexing dust collecting problems.

Low original cost *plus* continuous, efficient operation and low maintenance of WHIRLEX equipment assure quickest return of cost dollars!

For a completely integrated and co-ordinated installation, the following shop-assembled equipment is available:

WHIRLEX Type CTF Mechanical Gas Centrifuge Collectors
WHIRLEX Type MTSA 9CYT Multiple Cyclone Collectors
WHIRLEX Induced Draft Fans · WHIRLEX Forced Draft Fans
Special Duct Work · Self-Supporting Stacks
Support Structures



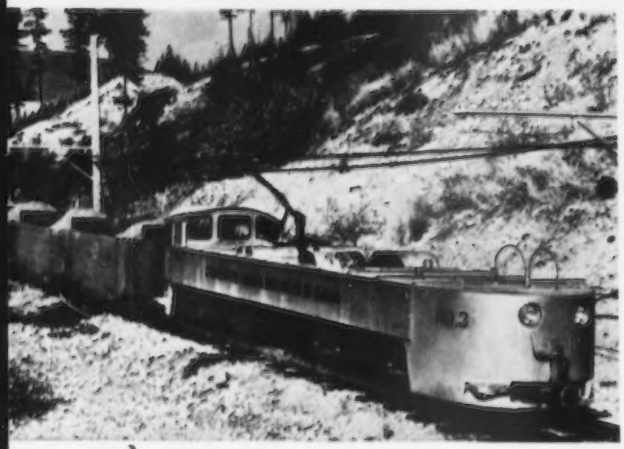
FLY ASH WHIRLEX ARRESTOR

Write today for complete engineering data . . .

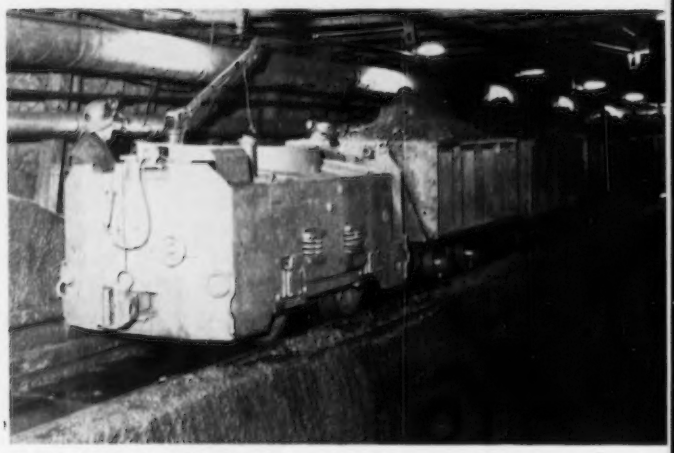
THE FLY ASH ARRESTOR CORPORATION

283 North First Street — Birmingham, Alabama

34,000 TONS OF MOLYBDENUM ORE are hauled each day from Climax Molybdenum Company's mine at Climax, Colorado. Seven of these 20-ton General Electric swivel truck locomotives help maintain this record haulage.



11,000 TONS OF ORE DAILY with three 40-ton G-E locomotives in operation at The Consolidated Mining & Smelting Co. of Canada Ltd.'s Kimberly, B.C. lead zinc mine.



PLANNING FOR INCREASED PAY LOADS resulted in the purchase of six 8-ton G-E locomotives by Jones & Laughlin Steel Corp. for their Negaunee, Mich. Tracy Mine.

3 Mines Boost Haulage Output with Efficient, Dependable General Electric Locomotives

Whatever your mine haulage or gathering operations may be, there's a General Electric mine locomotive that's right for the job. In an increasing number of mines, as in the case of the three pictured above, G-E locomotives are proving that haulage output and efficiency can be significantly increased with the correct motive power applied to a particular haulage need. For more information, or for a free survey of your haulage needs at no obligation to you, contact your General Electric Apparatus Sales Office. General Electric Company, Locomotive and Car Equipment Dept., Erie, Pa. 120-95

Progress Is Our Most Important Product

GENERAL ELECTRIC

The Right Pick is important. That applies to choice of trailing cords and cables, too. Be guided by the fact that veteran mine-men prefer TIREX. This expertly engineered cable, newly improved for greater flexibility, has cured-in-lead Neoprene Armor that resists abrasion, oil, heat and water . . . gives maximum wear.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street,
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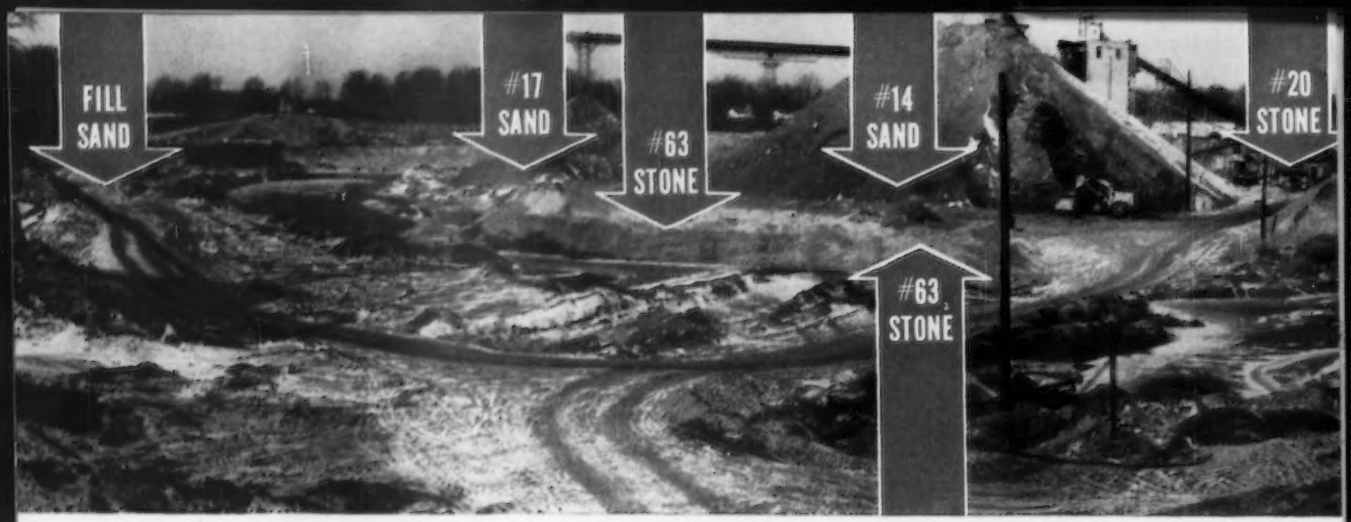
LIVE BETTER ELECTRICALLY

Simplex–TIREX



Same hours, same manpower, yet by changing loaders

INDIANA QUARRY QUADRUPLES PRODUCTION

With the same *number* of loaders, and virtually the same number of man-hours, May Sand & Gravel Company, Fort Wayne, has *quadrupled* production (and sales) over the past few years.

Key to their 750,000 ton yearly success story has been the three Michigan Tractor Shovels they brought in to replace a number of less mobile loading units.

Load 550 trucks with 4,500 tons

Accurate records, covering a two year period, show the three Michigans load from 300 to 550 trucks *every nine hour shift.* During peak days their output totals 4,500 tons —a per-unit per-hour average of 175 tons!

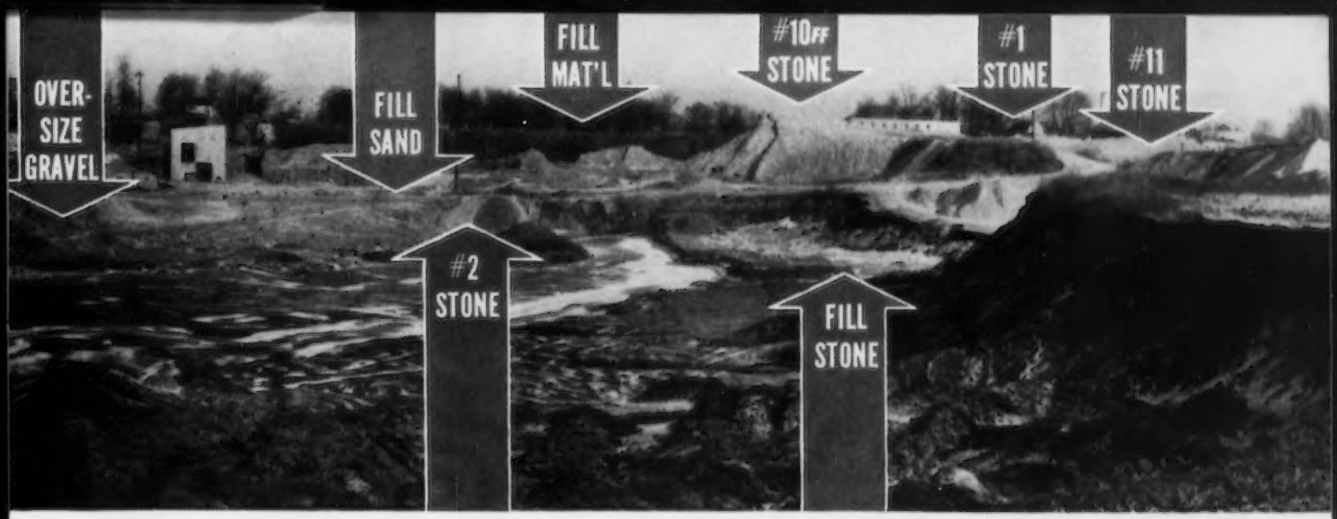
Truckers clear $25 more per day, end gripes

This excellent record has been compiled with only minor changes in methods. Trucks, for example, still are loaded in the order they come into the pit. Formerly, this practice caused frequent delays, often 20 to 40 minutes, while old-style loaders crawled between stockpiles, or labored to load the tougher materials. Now, *even on busiest days,* the Michigans work so fast no trucker waits longer than 2 to 10 minutes from time he drives into the yard until time he's loaded and pulls off the scales. "Trucker gripes have almost disappeared," says Company President Bill May. "The saving of 10 to 30 minutes in pit service often enables each truck to deliver another load or two a day when on long 15 mile hauls . . . an extra two to four loads a day when on shorter one to five mile hauls. That's an extra profit per truck of $5 to $25—or more—every day!"

Fast as trucks between stockpiles

Two major factors combine to produce this time saving. First, the mobile Michigans move from stockpile to stockpile just about as fast as the trucks. Second, the Michigans rapidly load all 10 sizes of stone, two types of gravel, and two grades of sand sold by this plant. Stopwatch measurements, taken from time to time during the past two years, show the 2¾ yard Michigans require only 1½ to 1¾ minutes to heap a 5 yd truck . . . 2¼ to 2½ minutes to load a 9 yarder.

Typical Michigan 2¾ yd load of #14 sand, heaviest of 14 materials handled, weighed out on company scales at 9,000 lbs.



Truck-like speed between stockpiles saves about 1¼ hours per day over crawler-loaders formerly used. Supt. Rooney estimates this time saving, plus lowered repairs, plus faster loading nets his company $70 extra profits per Michigan per shift.

Easy accessibility speeds maintenance

Another important factor in increased plant production has been *dependability*. May Sand and Gravel records show that *not once* in 5½ machine years has a Michigan missed more than a few hours of work. "Sure, we expect our rough service to take its toll," says Jim Rooney, Supt. "But we have a regular program of daily and 100 hour maintenance and inspection that catches what few troubles a Michigan has while they're small. Even when we spot something, even in the rare cases a Michigan breaks down, we always have the machine back to work the next morning! Easy accessibility, skilled workmen, and excellent distributor cooperation make repairs a simple job."

Also do such "extra jobs" as bank loading, pit cleanup

Speed and efficiency help out on extra jobs, too. Three hours every night, and sometimes during the day, one or two of the Michigans clean the quarry floor (this eliminates need for special tractor). Sometimes they load sand fill from bank direct into trucks. At times they level the gravel stockpiles. From 5 to 10 pm some evenings, two of them load non-blasted bank-run sand and gravel. Three trucks are kept busy hauling 2,000 ft to plant for processing. Only light source is own headlights. Average production: 230 tons per hour. And the Michigans have ended worries about rock shovel breakdowns. Supt Rooney reports production loading shot rock with a Michigan of 190 to 200 tons every hour.

Is it any wonder, with all-around performance like this, that May Sand & Gravel Company think Michigan "tops". We think, if you try one, you'll agree. Make your own test. Call or write to arrange a demonstration. You name the job!

Michigan is a registered trade-mark of

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
Benton Harbor 37, Michigan
In Canada: Canadian Clark, Ltd.
St. Thomas, Ontario

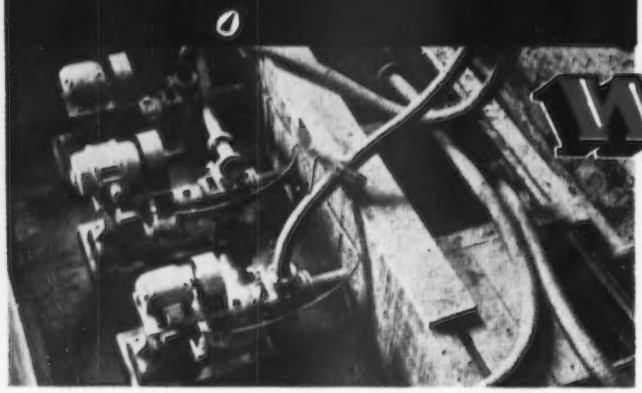
One of Michigan's "spare-time" jobs: hurrying to edge of 30 acre quarry to push off truck-dumped #1 stone.

Excellent service and cooperation from local distributor Deeds Equipment Company is one important reason for May's repeat purchases.

URANIUM

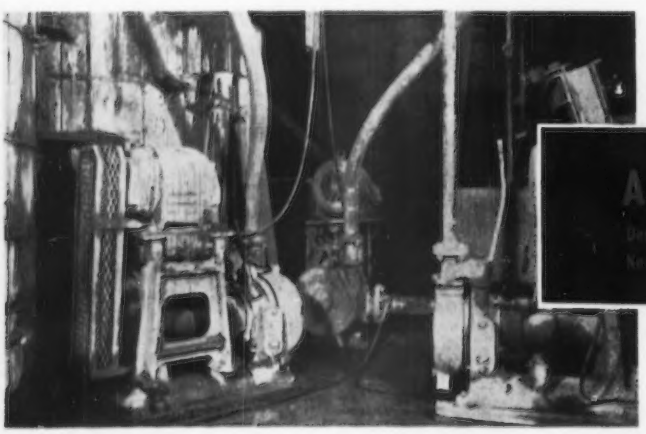
produced at lower costs with

WILFLEY PUMPS



WILFLEY ACID PUMPS receiving vanadium and uranium leach liquors from leach tanks and pumping them to various treatment tanks.

WILFLEY SAND PUMPS receiving the classifier overflow and pumping the material to the sand slime separation circuit.



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ENGINEERING AND MINING JOURNAL

JUNE 1957

New Mining Bill Needs Your Support

WHEN IT COMES TO PROSPECTING, the jackass and the single jack have long given way to the jeep and the jackhammer. But to look at some of our mining laws, conceived about 100 years ago, one would think that progress has been standing still in the mining industry.

Take the matter of annual labor, or "assessment work" as it is more commonly called in the field. Statutes requiring annual expenditures of $100 in labor or improvements to hold an unpatented claim have been so loosely written that lawyers in some areas have made more out of mining than the prospectors. It takes eight pages of fine print in Ricketts' "American Mining Law" just to index the court cases and decisions needed to clarify annual labor disputes.

This situation has become so untenable that some progressive Western States have written laws to supplement the parent Federal law. Diamond drilling is now accepted as valid assessment work in several states.

But it is more important that such modernization of mining laws be validated through the blanket coverage of Federal mining law. That is why Senator Bible's bill S2039, now up before the Committee on Interior and Insular Affairs, is so significant. It does two things: 1. Further clarifies statutes related to annual labor. 2. Recognizes the modern techniques of exploratory drilling; and geological, geophysical and geochemical surveys. Here is the bill:

A bill "To clarify the requirements with respect to the performance of labor imposed as a condition for the holding of mining claims on Federal lands pending the issuance of patents therefor.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2324 of the Revised Statutes of the United States (30 U. S. C. 28) is amended by inserting immediately after the third sentence thereof the following new sentence: 'The term "labor," as used in the preceding sentence, shall include, but not be limited to, the making of geological, geochemical, or geophysical surveys, exploratory drilling, or other recognized means of determining the existence, extent of concentration, or accessibility of minerals on the claim.'

"Sec. 2. The amendment made by the first section of this Act shall be effective with respect to the fiscal year commencing July 1, 1957, and all succeeding fiscal years."

It's high time that diamond drilling and other modern exploratory methods be qualified as valid assessment work by law—particularly when we recall that some claim holders in the uranium country have dragged a spike-studded log across the sagebrush for miles and called that road-building, i.e. annual labor.

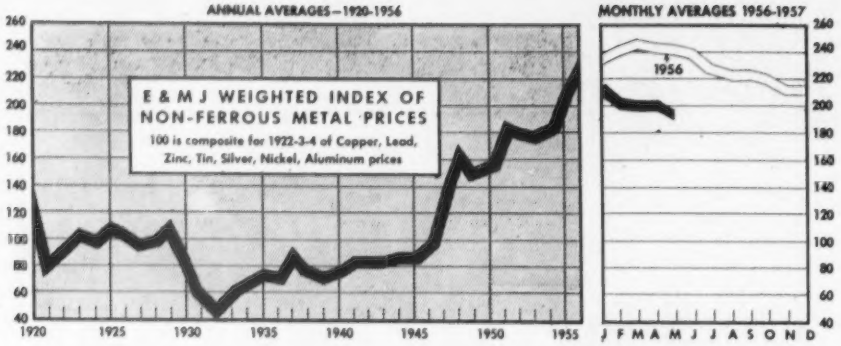
There should be little opposition to the new bills when they come up before Congress because they will benefit exploration and the development of domestic natural resources.

To people engaged in exploration work, geology, geophysics and the development of new properties, these bills will mean much. They should receive the firm support of mining men and companies offering exploratory services and equipment to the mining industry.

It is conceivable however that some of the Senators and Congressmen from non-mining states might be indifferent to the new bills. This might also be true of Representatives from such Middle West or Eastern mining states as Minnesota where Federal mining laws specifying assessment work do not apply. We suggest that mining men in these areas advise their Congressmen of the constructive features of the new bills. If you want extra copies of this editorial to include with your letter, drop us a line and we'll be glad to send them.

E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's metal price index dipped below the 200 mark for the first time since March 1955. Declining lead and zinc prices lowered the index from 203.34 in April to 198.77 for May. Barter program snafus could exert continued downward pressures.

●

LABOR

United Auto Workers' attempt to organize engineers at Minneapolis-Honeywell fizzled. UAW is trying hard to organize white-collar workers who now outnumber production workers. See p 119.

●

AT HOME

American industry will consume over one-million pounds of lithium metal annually by 1970 according to American Lithium Institute, Inc. This is several times the annual current production rate.

U. S. Borax Co. has over 80-million tons of high-grade reserves, enough to last 100 years at the current rate of consumption. Over $500,000 worth of boron compounds are now going into gasoline yearly. This market is expected to expand as more oil companies adopt boron additives.

Uranium plant capacity in the U. S., including mills operating and those under construction will total 18,785 tpd. Costs of these 23 mills are estimated by AEC to total $124-million.

One mining property in the Pima-Tucson copper boom area will involve the patenting of about 90 claims—believed to be one of the largest groups ever patented.

Automatic wage boosts are expected to push the steel prices up at least $5 a ton after July and aluminum pig up one-half to one cent per pound after August 1.

The auto industry, major metal consumer, has shaved total car output estimates for 1957 from 6.5-million to 5.85-million.

Discovery of Pyroceram by Corning Glass Works is called the most important breakthrough ever made in glass research. It can be made harder than steel or granite, 15 times stronger than plate glass and lighter than aluminum. Corning estimates that it will cost more than glass but less than steel.

Clinton Crane, retiring chairman of St. Joseph Lead Co., told stockholders that the company might have to accumulate a portion of its own metal if Government barter and stockpiling programs stopped before an effective long-range program replaces them.

●

ABROAD

Honduras, rich in mineral wealth, is now reorganizing its Mining Department and mining laws with specific intent to attract foreign investment. Robert Lawrence, well-known international exploration engineer, is expediting formulation of a modern mining code for Honduras.

Minerals Engineering Co. of Grand Junction, Colo., Rockefeller Center, Inc., and High Speed Steel Alloys, Ltd., England, plan to build a mill in the Transvaal, South Africa, with capacity to produce 3.6-million lb of vanadium concentrate annually.

MARKETS

Mineral Program Proposed; Lead and Zinc Price Cut; Weak Barter Starts

A LONG RANGE MINERAL PROGRAM was finally submitted by the Interior Department to the Senate Interior Committee—it was submitted as the Administration program and presumably has the President's support. It is much weaker than earlier proposals which were never made public. It offers much less than the mining interests wanted and expected, though they favor its higher tariff proposals. Its chances of acceptance by Congress this year are slim. Liberalizing amendments will be offered and may slow or prevent passage. Unlike earlier proposals, it does not include stockpiling, barter, special tax concessions, or subsidies except as stated below. A major proposal is the following variable import duties based on the average *E&MJ* prices for a three-month period. Interior suggested two schemes and indicated it preferred (A). It distinguishes between the existing import duties and the additional ones; at high prices it eliminates the present duties. We have added the two in order to make the effect clearer.

LEAD

	(A)		(B)	
Price, *E&MJ*, N. Y.	Ores	Metal	Ores	Metal
17¢ or above	zero	zero	zero	zero
16¢ to 17¢	¾¢	1½¢	½¢	1¢
15¢ to 16¢	1¾¢	2½¢	1¾¢	2¢
Below 15¢	2¢	3½¢	2¢	3¢

ZINC

	(A)		(B)	
Price, *E&MJ*, East St. Louis	Ores	Metal	Ores	Metal
14½¢ or above	zero	zero	zero	zero
13½¢ to 14½¢	.6¢	.7¢	.6¢	.5¢
12½¢ to 13½¢	1.3¢	1.45¢	1.2¢	1.25¢
Under 12½¢	2¢	2.2¢	1.8¢	2¢

The proposed program provides production subsides for three minerals. Beryl—when the Government's current program ends in 1962, the Government would pay, in addition to what the domestic miner gets by sale on the market, $70 per short ton for 10% BeO material with a limit of 100 tons per district per firm per year. Chromite—beginning July 1, 1959 when the present D.P.A. program ends, the Government would pay a bonus, over whatever the U. S. miner gets on the market, of $21 per long dry ton (46% basis) for domestically produced metallurgical grade. No more than 10,000 tons per year per firm per mining district would be accepted. A maximum of 50,000 tons per year would be accepted. Columbium-tantalum—$2.35 per lb combined pentoxide would be paid the miner in addition to what he received on the market. A limit of 5,000 lb per firm per mining district per year would be accepted and a total per year of 25,000 lb. The present pertinent section of P.L. 733 would end when this program begins. Asbestos—the Interior Department is exploring the possibility of providing a loan to the Apache Indians to build a mill to process the asbestos on their reservation.

Further mine exploration assistance and Bureau of Mines and Geologic Survey research is provided; also a continuous review of tax laws.

Barter by the Agriculture Department is being resumed. But the program is so restricted that many firms say they can expect to do little if any business. The Commodity Credit Corporation's major concern is to assure all barter deals would mean a net increase in surplus farm products exported. (1) The broker must assure CCC of the above except (2) with wheat, cotton and seed grains this will be automatically accepted (3) each contract will specify the farm product (4) the broker will pay interest when farm products are delivered before metal (5) brokers must assure CCC farm products will not be shipped to countries other than the one specified (6) barter metals may not be produced or processed in the U. S. (7) the country of origin must be designated—three-way deals must be approved.

CCC may stop barter if market conditions, other commitments or requirements make such action appropriate. No. 6 is a major difficulty—much past barter will be eliminated because no material smelted in U. S. smelters will be acceptable. It is doubtful metal switch deals to permit this will be acceptable to CCC.

Copper production is being cut further. Two Rhodesian Selection Trust companies, Roan Antelope and Mufulira, have announced on June 1 they would reduce output 10% as their "contribution to equating supply and demand." For Roan, this means about 700 stpm reduction and for Mufulira about 800 stpm. The RST Chibuluma mine will not reduce because it is new (which probably means it is at a stage of development such that its average costs are significantly higher than they will be if development is extended) and it is obligated to supply metal to the U. S. in repayment of a development loan from the Government. But RST still plans to continue its development work on Mufulira West and Chambishi. These may raise output by 80,000 tons when Kariba Gorge power becomes available in 1960.

Copper statistics released by the Copper Institute for April showed no significant change in the copper situation. World refined production was about 500 tons less than deliveries to fabricators. The data showed, as in previous months, deliveries to fabricators in the U. S. under the average for 1956 and deliveries outside the U. S. well over the 1956 average. U. S. crude primary and refined output were the highest since May 1956.

U. S. data for fabricated copper and brass products show April shipments sales better than March but still poor relative to the last half of 1955 and early 1956. Refined copper on order by fabricators is quite low.

Copper prices in May dropped somewhat. The *E&MJ* average came down from 31.517 to 31.288c in May. The drop reflects an increase in sales by low price sellers relative to other sellers' sales and also sales were made at lower prices by smelters.

The London Metal Exchange price weakened during the month but firmed, reputedly with heavy buying by the RST companies. At the end of the month it was down again. Copper was added to the U. S. barter list. This may have a slight firming effect on prices.

An agreement on price policy has been reached by the two Rhodesian copper producers, the Rhodesian Selection Trust Group and the Oppenheimer group. It has been submitted to consumers. Some consumers are reported hesitant. Apparently the proposal would be somewhat like RST pricing the past year but probably it would be subject to changes a little more often. If it is accepted, the amount of "fixing" sales on the LME may be greatly reduced. The LME might also become a thinner market though this does not necessarily follow. Agreements by a few producers might reduce the volatility of prices—but not enough producers could get together to fix prices.

Representative Patterson submitted to the U. S. Congress a bill to limit imports of copper and brass products. No action is expected this session.

Domestic zinc prices were cut 1½c per lb on May 6; ½c on May 13, and another ½c on June 4. Poor private and Government business, and expectations of little improvement (if any) in either were responsible. London zinc continued to drop and on May 31 it was about 10c. The barter resumption announcement did not strengthen it. U. S. higher import duties would tend to weaken foreign zinc—but no one expects duties to be raised soon. The Government accepted more zinc for stockpile in May than in April.

Lead prices were reduced to 15½c N. Y. May 9—a leading custom smelter took the lead. They were dropped to 15c on May 17. Late in April the London and N. Y. lead price differential had reached 3⅞c—the U.S. price was certain to come down. GSA took more lead in May than in previous months. Lead business has not improved.

Aluminum markets remain weak. There is some uncertainty if the Government will accept aluminum from now on. No one expects a primary price rise.

MARKETS *(Continued)*

Average Prices May (*E&MJ* Quotations)

Copper:	
Electrolytic, domestic refinery	31.288
Electrolytic, export refinery	29.448
Lead:	
Common, New York	15.385
Common, St. Louis	15.185
Silver and sterling exchange:	
Silver, New York, per oz.	91.307
Silver, London, pence per oz.	79.223
Sterling Exchange	279.096
Zinc:	
Prime Western, East St. Louis	11.923
Prime, Western, delivered (g)	12.423
Tin:	
New York Straits	98.409
Gold, per oz. U. S. price	$35.000
Quicksilver, per flask	$255.000
Antimony, *(E&MJ)* (d)	36.590
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$92.000
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	27.100
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(e) Tin content.

(f) Contract price, f.o.b. Port Colborne, U.S. duty included. Other regular sellers 78¼¢ to $1.25.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

May trading rose 4%. French and Indian activity increased; record prices were paid for coins and bars. Paris listed 35% premium of coins against bars, the highest in the world. Soviet gold sales of about $15-million were reported from Switzerland. Europe was active. Asiatic trading centered in Bombay. Djakarta reported higher gold prices. Central and South America trading was quiet. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Apr. 30	May 31	Apr. 30	May 31
NEW YORK, transit	.....	.....	$35.08	$35.08
MANILA	$43.75	$43.75	36.45	36.50
HONG KONG	42.25	44.10	37.95	38.30
BOMBAY	59.00	59.75	58.75	59.00
TANGIER	43.60	42.75	34.90	34.92
BEYROUTH	43.20	43.30	35.05	35.04
PARIS	46.50	46.90	36.75	36.45
BUENOS AIRES	39.35	39.00	35.60	35.50

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

May 1957	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	31.600	30.175	16.000	15.800	14.000	13.500	25.000	98.750
2	31.500	29.725	16.000	15.800	14.000	13.500	25.000	99.000
3	31.475	29.950	16.000	15.800	14.000	13.500	25.000	99.125
4	No Market	29.950	16.000	15.800	14.000	13.500	25.000	99.125
6	31.575	29.850	16.000	15.800	12.500	12.000	25.000	99.000
7	31.325	29.625	16.000	15.800	12.500	12.000	25.000	96.625
8	31.575	29.575	16.000	15.800	12.500	12.000	25.000	98.375
9	30.925	29.825	15.500	15.300	12.500	12.000	25.000	98.250
10	31.150	29.425	15.500	15.300	12.500	12.000	25.000	98.375
11	No Market	29.425	15.500	15.300	12.500	12.000	25.000	98.375
13	31.025	29.700	15.500	15.300	12.000	11.500	25.000	98.000
14	30.950	29.775	15.500	15.300	12.000	11.500	25.000	98.000
15	31.100	29.300	15.500	15.300	12.000	11.500	25.000	98.500
16	31.500	29.525	15.000	14.800	12.000	11.500	25.000	98.250
17	31.525	29.375	15.000	14.800	12.000	11.500	25.000	98.250
18	No Market	29.375	15.000	14.800	12.000	11.500	25.000	98.250
20	31.325	29.025	15.000	14.800	12.000	11.500	25.000	97.875
21	31.300	29.050	15.000	14.800	12.000	11.500	25.000	98.000
22	31.150	29.200	15.000	14.800	12.000	11.500	25.000	98.000
23	31.275	29.375	15.000	14.800	12.000	11.500	25.000	98.125
24	30.950	29.450	15.000	14.800	12.000	11.500	25.000	98.250
25	No Market	29.450	15.000	14.800	12.000	11.500	25.000	98.250
27	31.250	29.075	15.000	14.800	12.000	11.500	25.000	98.375
28	31.300	29.175	15.000	14.800	12.000	11.500	25.000	98.375
29	31.300	28.975	15.000	14.800	12.000	11.500	25.000	98.500
30	Holiday	28.750	Holiday					
31	31.250	29.000	15.000	14.800	12.000	11.500	25.000	98.625
AVERAGES FOR MONTH								
May	31.288	29.448	15.385	15.185	12.423	11.923	25.000	98.409
AVERAGES FOR WEEK								
May								
1	31.510	29.604	16.000	15.800	14.000	13.500	25.000	99.604
8	31.490	29.779	16.000	15.800	13.250	12.750	25.000	98.875
15	31.030	29.575	15.500	15.300	12.250	11.750	25.000	98.250
22	31.360	29.258	15.000	14.800	12.000	11.500	25.000	98.104
29	31.215	29.250	15.000	14.800	12.000	11.500	25.000	98.213
CALENDAR WEEK AVERAGES								
May								
4	31.505	29.796	16.000	15.800	14.000	13.500	25.000	99.021
11	31.310	29.621	15.750	15.550	12.500	12.000	25.000	98.500
18	31.220	29.508	15.250	15.050	12.000	11.500	25.000	98.208
25	31.200	29.258	15.000	14.800	12.000	11.500	25.000	98.083

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent. Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotion.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Jan. 1, 1951, commanded a permium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic commonn lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

May 1956	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
1	91.375	79.625d.	279.2187	250s. 2¼d.	$35.00
2	91.375	79.500d.	279.3750	250s. 1d.	35.00
3	91.375	79.500d.	279.3750	250s. ¼d.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	91.375	79.375d.	279.3125	250s. 1¼d.	35.00
7	91.375	79.375d.	279.3250	250s. 1¼d.	35.00
8	91.375	79.375d.	279.1562	250s. 2¼d.	35.00
9	91.375	79.375d.	279.1125	250s. 4d.	35.00
10	91.375	79.375d.	278.9375	250s. 3¾d.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	91.375	79.375d.	279.0625	250s. 3½d.	35.00
14	91.375	79.250d.	278.9875	250s. 3½d.	35.00
15	91.375	79.250d.	278.8750	250s. 4d.	35.00
16	91.375	79.250d.	278.9062	250s. 4¼d.	35.00
17	91.375	79.250d.	278.8312	250s. 5d.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	91.375	79.250d.	278.9812	250s. 5¼d.	35.00
21	91.375	79.250d.	279.0000	250s. 4½d.	35.00
22	91.375	79.250d.	279.0625	250s. 4½d.	35.00
23	91.375	79.250d.	279.1718	250s. 4¼d.	35.00
24	91.375	79.250d.	279.0000	250s. 4¾d.	35.00
25	(e)	(e)	(e)	(e)	35.00
27	91.375	79.250d.	279.1250	250s. 5d.	35.00
28	90.875	79.250d.	279.1625	250s. 4d.	35.00
29	90.875	78.500d.	279.1125	250s. 4¼d.	35.00
30	Holiday	78.500d.	Holiday	250s. 5d.	Holiday
31	90.875	78.500d.	279.0312	250s. 5¼d.	35.00
AVERAGES FOR MONTH					
May	91.307	79.223d.	279.096	—	35.00
AVERAGES FOR WEEK					
May					
1	91.375	—	279.100	—	35.00
8	91.375	—	279.309	—	35.00
15	91.375	—	278.995	—	35.00
22	91.375	—	278.956	—	35.00
29	91.175	—	279.114	—	35.00

Calendar Week Averages: New York Silver: May 4th, 91.375; 11th, 91.375; 18th, 91.375; 25th, 91.375.

(e) No Market (Saturday).

London Metal Exchange Quotations

May	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	240¼	240½	241	241¼	109	109¼	109	109¼	94¼	94½	91	91¼	769½	770	769½	770
2	240¼	240½	240¾	241	108¾	109	108¾	109	93¾	94	90	90¼	772½	773	770½	771
3	240¾	241	241	241¼	109	109¼	109¾	109½	94	94½	90½	90¾	772½	773	771½	772
6	240¾	241	241	241¼	108¾	109	108¾	109	92½	92¾	89	89¼	770	771	770	771
7	240	240¼	240¼	240½	105	105¼	105¼	105½	86½	86¾	83	83¼	767	768	766½	767
8	239¾	240	239½	239¾	99¾	100	100¼	100½	85¾	86¼	82½	83	764½	765½	764	765
9	238¾	239	237¾	238	95½	96	96	96½	84¼	84¾	80¼	80¾	761½	762	760½	761
10	238½	238¾	237½	237¾	98¾	99	99	99½	84½	84¾	80¾	81	764½	765	763	763½
13	238	238¼	237	237¼	97	97¼	97½	97½	82¾	83	78¾	79	761	762	759	760
14	235¾	236	235	235¼	95	95½	95¾	96	83	83½	78½	79	762	762½	759	759½
15	237¼	237½	236¼	236½	95	95¼	96¾	97	85	85¼	80	80¼	764	765	761½	762½
16	236¾	237¼	236	236½	95½	95¾	95¾	96	83¼	83¾	79½	80	765	766	761	761½
17	235½	235¾	235	235¼	95	95½	95½	95¾	83½	84	79¾	80	762½	763	759½	760
20	234½	234¾	234¾	235	96¼	96¾	96¾	97	84	84½	80¼	80¾	763	764	761	762
21	235½	236	236½	237	96½	96¾	96¾	97	84	84¼	80¾	81	764	765	760½	761
22	239¾	240	240½	241	99½	99¾	99½	100	88	89	84¼	85¼	765	765½	762	762½
23	239½	239¾	240	240¼	98½	99	98½	98¾	85½	86	82½	82¾	764½	765	762½	763
24	237½	237¾	238¼	238½	97¾	98	97¾	98	84½	84¾	81½	81¾	765	765½	762	763
27	236½	236¾	237¼	237½	96¾	97	96¾	97¼	82½	82¾	79¾	80	764½	765	762	762½
28	235½	235¾	236½	236¾	97	97½	97¼	97½	83¾	84¼	80¾	81¼	764	764½	761½	762
29	235	235½	236½	236¾	96¾	97	97¼	97½	81¾	82	79¾	80	763	764	761½	762
30	235¾	236	236¾	237	96¾	97	97¼	97½	81	81¼	79¼	79½	763½	764	761½	762
31	236	236¼	237¼	237½	96¼	96½	97¼	97¼	80½	80¾	79	79¼	763	764	761½	762
Av'g's	£237.870		£238.060		£99.462		£99.804		£85.777		£82.413		£765.402		£763.424	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98¾ and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton.

MISCELLANEOUS METALS

May 31, 1957

Aluminum ingot, 99 plus % lb.			27.1¢
Antimony, spot, lb. less than carload, in cases			36.59¢
In bulk, carload lots, f.o.b. Laredo			33.00¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.70
Calcium, lb. ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb. contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$2.00
Germanium, per gram, 10,000 gram lots	38¢	@	43½¢
Indium, troy oz.			$2.25
Lithium, lb. 98%	$11.00	@	$14.00
Nickel, cathodes, lb. (a)			74¢
Other sales, reg. sellers	88½¢	@	$1.345
Sales by dealers, etc.			$1.60
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16			35¼¢
Palladium, troy oz.	$23.00	@	$24.00
Platinum (wholesale lots), troy oz.	$90	@	$95
Quicksilver, flask of 76 lb., 25 flasks or more	$255	@	$257
Selenium, 99 plus %, lb. (May 28, 1957)			$10.50
Silicon, minimum 97%, carloads, lb.			20½¢
Semi-Conductor grade, lb.			$330
Tellurium, lb.			$1.65
Thallium, 100 lb. or more, lb.			$12.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb.			(b)$2.75

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Dec. 3, '56.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$37.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$30	@	$30.50
48% Cr_2O_3 3 to 1 ratio	$55	@	$60.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi, non-bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$184.92
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.49 @ $1.53; both duties excluded, $1.355 @ $1.395. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18	@	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.35	@	$1.40
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$17.75	@	$19.00
U. S. mined concentrate, per stu, f.o.b. mill (GSA price) (Suspended)			$55
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$84.00

(a) Nominal.
(e) Eff. 1957 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52	@	$1.55
Copper Sulphate, 100 lb. eff. Oct. 25, '56			$13.90
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb of Mo	$1.38	@	$1.41

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr. (4-9% C)			27¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12¾¢
Ferromolybdenum, 58 to 64% Mo, lb. of Mo contained	$1.68	@	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)			13¢
Ferrotungsten, 72 to 82%, lb. of W contained			$2.95
Ferrovanadium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb., contracts			12.8¢
Spiegeleisen, per long ton, 19 @ 21% grade eff. Jan. 7			$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$1,400	@	$1,725
Crude No. 2	$750	@	$1,100
Spinning fibers	$350	@	$650
Shingle fibers	$190	@	$210
Paper stock	$114	@	$137
Waste	$82	@	$84
Shorts	$28	@	$75
Asbestos, f.o.b., Vancouver, B. C. (U. S. funds):			
Spinning fibers	$470	@	$750
Shingle fibers, effective Jan. 1	$210	@	$310
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	@	$383
Shingle stock	$172	@	$190
Paper stock	$114	@	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	@	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, at	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(a)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$ 8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.50
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)			$50.00
Some sales at			$55
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$40.00
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$32.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright			$26.50
dark			$25.50
Mexican, per lt, f.o.b. mines, dark, 280 pesos			$22.40
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra white			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a)Some restricted sales at $11.50. (b) Corrected.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$64.50
Steel, f.o.b. Pittsburgh, billets, net ton			$74.00
Structural shapes, Pa., Ala., etc., 100 lb.	$4.85	@	$5.00

THIS MONTH IN MINING

Duval Announces Arizona Copper Venture: AS&R Is High Bidder for Land in Same Area

THE AREA south of Tucson, Ariz. has been the site of a great deal of increased activity in recent weeks with two important announcements by American Smelting & Refining Co. and Duval Sulphur & Potash Co., of Houston.

AS&R bid $1,066,007 for exclusive exploration rights to three tracts of land on the Papago Indian reservation in the area which begins 12 miles southwest of Tucson and extends 20 miles further southwest. Smaller bids on each tract were made by three other companies.

The lands which AS&R bid for contain 15,000 acres in the general area where Pima Mining Co. operates its copper pit and Banner Mining Co. has an underground operation.

The bid must be approved by the Papago Indian tribal council and individual indians who hold land allotments.

Duval Sulphur is planning a $20-million copper-molybdenum mine 25 miles southwest of Tucson. The open pit operation will be similar to AS&R's Silver Bell mine and is expected to go into operation in late 1959. Construction will get underway shortly.

Eugene German, vice president and treasurer of Duval, says ore deposits totalling "nearly 100-million" have been discovered on the property, five miles southwest of Twin Buttes.

Company plans call for a 10,000-tpd processing operation. Ben G. Messer, local manager for Duval, said that his company has been conducting exploration in the area for some two years. The two other operations in the Twin Buttes area are producing 4,350 tpd, with Pima contributing 3,500 tpd.

Largest operation in the Tucson area is the San Manuel Mine (*E&MJ*, April 1956) which handles 35,000 tpd.

Gold Fields Chief Explains Rand Operations

THE HIGH RELIABILITY of diamond-drill prospect holes on the Rand and Orange Free State gold fields amazed members of the Mining and Metallurgical Society of America who listened to a talk on South African gold mining problems by Robert Annan, chairman, Consolidated Gold Fields of South Africa, Ltd., in New York on May 14. Only 11 boreholes on a 37-mile strike were required in the West Witwatersrand to enable companies to raise capital and go ahead with development of new mines in the area. In the Orange Free State, Mr. Annan recalled that an area of 8,500 square miles was held under option in 1946. This was soon narrowed down to 200 square miles. One block about 20 miles long was prospected with only 100 boreholes. Where mines have been started up, tonnage and grade of ore produced have checked "quite satisfactorily" with diamond-drill hole indications, according to the speaker.

Approximately one-third of the profits in the South African gold fields in 1956 was derived from uranium, Mr. Annan said. Gold profits were about £48-million and uranium, £24-million. Seventeen uranium plants are now serving 28 mines in the area. Capital investment in uranium plants total £65- to £70-million. Since uranium purchase contracts run to the 1963-1966 period, amortization rates are set for such expiration dates. Uranium content of ore or slimes treated runs from ¼ lb to 2¼ lb per ton. No consistent relationship between gold content and uranium content has been indicated in South African gold operations.

Mining economics of the South African gold area were summarized in part as follows by Mr. Annan: Cost of a 100,000-tpm operation has increased from £4½-million prior to World War II to £12- to £14-million today. It takes about five years to bring in an average producer of this size. Speed of development is very important, and a saving of £2-million can be made for each year saved in bringing in a producer. That is why so much emphasis is placed on rapid mechanical development methods in South Africa. Average recovery per ton is about $8. The range is from $3½ to $33 per ton. It wouldn't be worth developing anything below $10 rock today. During the next three or four years it is expected that profit and grade for new mines will tend to rise.

Unusual Ice Conditions Delay Iron Shipping Date

THE 1957 IRON ORE SEASON for the Mesabi range opened April 8 when ore loading began at several range mines of Oliver Iron Mining Division, M. A. Hanna Co., Republic Steel Corp. and Pacific Isle Mining Co. The Arthur M. Anderson of Pittsburgh Steamship Division (U.S. Steel Corp.) was the first boat to arrive at the Duluth-Superior harbor. The 647-ft ore carrier came in shortly after 6 a.m. on April 9. Later in the day other boats arrived at Two Harbors and Duluth-Superior in spite of heavy ice conditions at the eastern end of Lake Superior and Whitefish bay. Four of a second convoy of nine ore boats bucked their way through April 9 behind the Coast Guard icebreaker.

On April 10 the third convoy of the season was held up at Whitefish bay because northwest winds had begun to bank up the ice to a height of six feet. The winds increased and by April 12 the ice field had become 45 miles long and 30 to 60 miles wide with windrows piled up 14 ft to 25 ft high. On the 12th Lake Superior was closed to shipping by the Coast Guard until further orders. On the 13th four Coast Guard icebreakers required four hours to open a path for three ore boats for two miles, with 10 to 12 miles of ice jam still ahead. Other boats were held fast in the ice and left until icebreakers could release them. Strong northwest winds continued. Ships still in the Duluth-Superior harbor were ordered to remain there; and 13 southbound ships at the northern edge of the ice field were directed to stay put. There were 25 vessels below the Soo locks waiting to proceed north.

By April 15, seven icebreakers, the greatest such concentration in lake history, were battering away at the ice in Whitefish bay and the St. Mary's river. Nine boats that had been jammed in Whitefish bay were freed and proceeded north. Old ore boat captains described the ice jam as the worst in 48 years.

The George A. Sloan, carrying about 10,000 tons of ore, suffered several cracked plates on the 16th, due to the crushing ice pressure in Whitefish bay. The boat took on water but was able to get to the Soo where ship traffic between Lake Huron and Lake Superior was held up on the 17th while lighters unloaded the cargo.

By the night of April 17 ice conditions had improved sufficiently to permit upbound and downbound convoys of 15 ships each to move through Whitefish bay with five icebreakers assisting them. The Coast Guard reduced from 2,000 hp to 1400 hp the minimum for ships to travel through the ice field area.

During much of this delay to the passage of ore boats it was necessary to suspend ore loading at the mines.

Consequently, due to a freak of nature, an ore season that had been planned for an early one was subjected to delays that held back the regular movement of ore to a later date than the average one of April 15.

Republic Steel, National Lead Form R-N Corp.

REPUBLIC STEEL CORP. and National Lead Co. have announced the formation of R-N Corp. The new organization has developed a direct reduction process for the treatment of both low-grade and high-grade iron ores, which will provide the steel industry with high metallic iron feed materials for use in blast furnaces, electric, open hearth and cupola furnaces.

The R-N process was originally devised by National Lead in the course of research on the separation of iron and titanium from titaniferous ores. National Lead and Republic Steel have joined as a mutual development team to

conduct research work on iron ores. A pilot plant, constructed in 1954 at Republic's Spaulding Mine near Birmingham, Ala., has been producing high metallic iron stock in quantities sufficient for commercial testing purposes.

Mining Calendar

Idaho Mining Assn., Sun Valley Idaho. July 15-16

American Mining Congress, 1957 Metal Mining and Industrial Metals Convention, Salt Lake City, Utah. Sept. 9-12

International Mineral Dressing Congress, Stockholm, Sweden. Sept. 18-21

Exploration Drilling Symposium, University of Minnesota, Minneapolis, Minn. Oct. 3-5

Southeastern Mining Society Conference, AIME, Hillsboro Hotel, Tampa, Fla. Oct. 15-18

Rocky Mountain Minerals Conference, AIME, Denver, Colo. Oct. 30-Nov. 1

Longyear Will Drill in Grants-Ambrosia District

EXPLORATION DRILLING in the biggest block of land in the Grants-Ambrosia Lake area of McKinley County, N.M. will be undertaken by E. J. Longyear Co. shortly. Contract was signed last month with Yucca Mining & Petroleum Co., Inc. and a limited partnership of investors operating under the name of Mineral Project-Venture B. Ltd.

Longyear will manage the exploration program over a 16,000-acre area, located some 6 miles east of Ambrosia Lake. The so-called San Mateo dome structure reportedly is uplifted, with hilly, rough terrain. Financing for the San Mateo project will come from Lisbon Uranium Corp., controlled by Atlas Corp., and from Mineral Project-Venture B.

Kermac Nuclear Signs For Third Ambrosia Mill

ATOMIC ENERGY COMMISSION and Kermac Nuclear Fuels Corp. have signed a contract under which Kermac will construct a 3,300-tpd mill in McKinley County, N.M. Construction is underway with completion set for July 1958. Site of the mill, Kerr-McGee's second in the area, is 25 miles north of Bluewater: first mill was constructed at Shiprock.

Cominco Plans Pig Iron Plant for Kimberley, B.C.

CONSOLIDATED MINING & Smelting Co. of Canada Ltd. announced recently that it is planning an iron plant at Kimberly, British Columbia.

At the annual meeting in Montreal, Cominco president R. E. Stavert said, "We are now considering the production of pig iron and steel from the pyrrhotite tailings from the Sullivan Mine.

According to the *Canadian Press*, initial costs of the proposed plant will run about $5-million.

As We Went to Press . . .

A dissatisfied mining industry voiced objections to the final, and submitted draft of the Administration's long-range mining doctrine, pieced together after more than three years of haggling between the various Government agencies—Interior, State, Treasury, Agriculture, Commerce and Office of Defense Mobilization.

The five-point plan Interior Secretary Fred A. Seaton sent to Capitol Hill May 27 proposes sliding-scale import excise taxes on foreign produced lead and zinc (aimed at stabilizing domestic prices at 16c and 13½c, respectively), a stepped-up technical research and mineral development aid program, specific production bonuses for beryl, chromite and columbium-tantalum, a review of mining tax laws, and a recommendation for continued stockpiling of the four metals and minerals in PL 733.

Producers of other metals are asking, "What about us?" Their drive to liberalize the doctrine revolves around Senate support led by Interior Committee chairman James E. Murray (D-Mont.), who immediately called for hearings for June 4. The Administration doctrine faces a hard fight even as it is now written. Liberalizing amendments will slow final passage even more, with the result that nothing will be enacted before next year. Murray may press for an outright domestic price subsidy in place of the doctrine, but this move stands even less chance of acceptance by a budget-minded Congress.

In a sudden switch from suspension of the barter program (see p118) the Government has authorized a program which permits barter of domestic farm surpluses for foreign strategic metals and minerals on a sharply curtailed basis. Revised program set up by the Department of Agriculture tightens responsibility of brokers who handle the actual trading.

Some of the new restrictions include: (1) burden of proof that any given deal will result in a net increase of U. S. farm crop export; (2) a new requirement that metals and minerals acquired in barter must be both mined and processed overseas; (3) an interest charge on money the broker may get from sale of the crop before purchase of the metal; (4) tighter designations of what crops are to be bartered for what minerals, and the origins of the foreign minerals; (5) bans on unauthorized three-way trades and deals.

There are also special restrictions on the barter of wheat, cotton and feed grains (primarily corn)—which cannot be bartered in specific countries without special approval. Object of the restrictions is to prevent barter deals from cutting into cash sales of domestic crop surpluses.

Copper has been added to the list of materials ODM will accept in barter deals for stockpiles.

Agriculture officials admit that the reinstatement of barter came hurriedly as a result of pressure from the farm bloc and export-import traders. There is talk that the whole program may be in for still further review, and that the new restrictions may be loosened somewhat.

Domestic mining opposition to many aspects of the barter program also played a part in its suspension and revision—although the requirement that all bartered materials must be both produced and processed abroad dims domestic producers hopes that the program might be liberalized to allow trade of domestic metals and minerals for farm crops.

Behind the By-Lines...

G. P. Lutjen

We're as pleased as a hard rock miner with a pay boost, to welcome back John Allingham whose article "How to Reduce Gold Losses in Cyanide Mills" appears on p 101. Mr. Allingham has been a long time gone; his previous contribution to *E&MJ* was in September 1916 when he wrote the article, "Treating Amalgamation Tailings." Mr. Allingham has retired as a metallurgist and is living in Fontana, Calif. It's awfully nice to have his by-line again.

One of the most sought after men in the early 1957 Eat & Speak Circuit (Mining Division), was Phil Jenney, geologic consultant, currently operating out of Toronto.

Phil has done an outstanding job of sorting out what's going on in the fabulous New Brunswick mining area. His talk before the pros in the exploration game at the Canadian Prospectors Association early in March was one of the most articulate roundups on a booming mining camp that we have seen. So enthusiastic were reports by the audience that the New York Section of AIME persuaded Mr. Jenney to give a repeat performance at its April meeting. The house was packed and *E&MJ* editors felt that their 20,000 subscribers ought to be cut in on the story. With Mr. Jenney's permission we are presenting a condensed version of his talk on p 95.

This month we're plugging for a uranium miner up in the Ramapo Mts. His name is Sidney Lieberman and he's building a mill to be ready in August for the crushing, grinding and air separation of his ore. His big problem is that he has to sell the magnetite and crushed rock that comes with the U_3O_8 to make a profit. So far he's overcoming these and other obstacles like mild skepticism on the part of old hands in the uranium business.

To get a first hand report on how Sid is doing, a couple of *E&MJ* editors packed a picnic basket a while back, selected a delightful spring day and motored up to Warwick, N. Y. Their report, submitted with a leftover peanut butter and jelly sandwich, is being published on p 81 of this issue.

Not in this issue, although we said it would be, is Part II of the May article, "How to Select Your Conveyor Belt." The standard story in cases like this usually involves, "circumstances beyond our control." While it's true that circumstances get pretty uncontrollable when you're putting out two issues as we do in June, we can't really offer it as an excuse. Instead we can only assure you that Part II is in the works for July.

We Told You So Department. The following is a verbatim Associated Press dispatch which we have been saving for some time.

"Ipswich, England, Jan. 14—A mental patient at an Ipswich hospital today won £30,000 ($84,000) for a two pence stake in a football pool."

This substantiates an observation we made here several years ago: "You don't have to be crazy to bet on football games, but it helps."

A new record for candor among movie stars was established in another A. P. dispatch. The lead paragraph, word for word, follows.

"Rome, Jan. 3—Gina Lollobrigida is going to have a baby. She announced today: 'I must confirm that I am expecting a child. It has become too difficult to say *no* all the time'."

The next paragraph straightened the situation out but not before it had given us quite a turn. It seems Miss L. and her husband had been saying "no" to stork rumors for some time.

Two good stories were among the minor benefits derived from attendance at the Coal Show, an awesome display of coal mining equipment that played in Cleveland last month under the auspices of the American Mining Congress. Both stories, oddly enough, are on the pachydermal side, a subconscious reflection perhaps of the size of the show.

The first concerns a well traveled geologist who was about to order a meal in a new restaurant when he noticed a sign on the wall offering $1,000 to anyone who could order a dinner, no matter how bizarre, that the restaurant could not furnish.

"An easy thousand," thought the geologist, and when the waiter came for his order, he casually asked for fried elephant ears on a bun.

Without batting an eye, the waiter inquired whether the gentleman would prefer African or Indian elephant.

With equal aplomb our geologist friend tossed off, "African, of course."

The waiter disappeared but after six or seven minutes returned with a big grin on his face. "Well, sir, you win the $1,000," he said with a laugh. "We're all out of buns."

The second story concerns the commuter who sat in the first car of the Chicago-Milwaukee rapid transit cannonball each day and carefully tore his newspaper to bits, trickling the scraps out of the window.

The conductor watched this performance for several days. When his curiosity got the better of him he finally inquired politely into the passenger's motives. "What's the big idea of tearing up the paper and throwing the pieces out the window?"

"To keep the elephants off the track," replied the commuter with poorly concealed disdain over the stupidity of the question.

"Look, chum, there are no elephants for miles around here."

"I know," said the commuter with a self-satisfied smile. "Effective, isn't it?"

FIG. 1. ENGINEERS of the Marion Power Shovel Co. and the General Electric Co. observe the electronic analogue computer which speeded design and construction of the crowd, swing and M-G set of the world's largest shovel.

Electronic Computer Speeds Design Of World's Largest Power Shovel

M. A. NESLIN

R. P. LANG

THE "MOUNTAINEER" is the largest, fastest, most powerful shovel in operation. It is used for stripping overburden to expose a seam of coal at Hanna Coal Co., Adena, Ohio. Its outstanding performance is, in part, due to the fact that its electrical equipment was designed with the aid of an electronic analogue computer. Its four main functions of hoist, crowd, swing and propel are shown in Fig. 2. On the "Mountaineer" these are all electrically independent and utilize the following types of equipment:

Hoist, dc motors and generators. Amplidyne voltage regulator with amplistat current-limit. Two separate armature loops, each consisting of two generators and two motors. Each generator designed for maximum of 600v (see Fig. 3).

Crowd, dc motors and generator. Amplidyne voltage regulator with amplistat current-limit. One armature loop consisting of two motors in series with one generator with maximum generator voltage of 1,100v.

Swing, dc motors and generators. Amplidyne voltage regulator with current-limit (no amplistats). No shock loading. Two separate armature loops, each consisting of two motors and one generator with maximum generator voltage of 1,100v.

Propel, four 250-hp, 440v, wound-rotor induction motors (one on each corner of the lower frame). Two steps of secondary resistor.

Motor horsepower ratings for the various operating motions of the "Mountaineer" were selected (as is customary) by the shovel manufacturer, the Marion Power Shovel Co. These ratings were selected on the basis of moving a given volume of material of a certain density the necessary distance in a specified time. Generators were specially designed to develop 230% rated motor current with the bucket stalled and 230% rated motor horsepower while digging. These units are capable of a duty cycle of 45 sec. The shovel works 24 hr a day, 364 days a year, less some down time for maintenance.

Despite immense size and power of the "Mountaineer," one operator must have complete control of the entire machine to obtain maximum production. The machine must respond promptly to the operator's demands. At the same time the operator is freed from making decisions which will require him to anticipate or keep him tense. For example, when the operator is digging at high bucket speeds he must simultaneously control the crowd and hoist motions to keep the power level high. Immersion of the bucket in the bank prevents the operator from foreseeing solid rock ledges which

Mr. Neslin is General Electric Co.'s Systems Application Engineer for Mining, and Mr. Lang is GE's Industry Control Engineer for Mining.

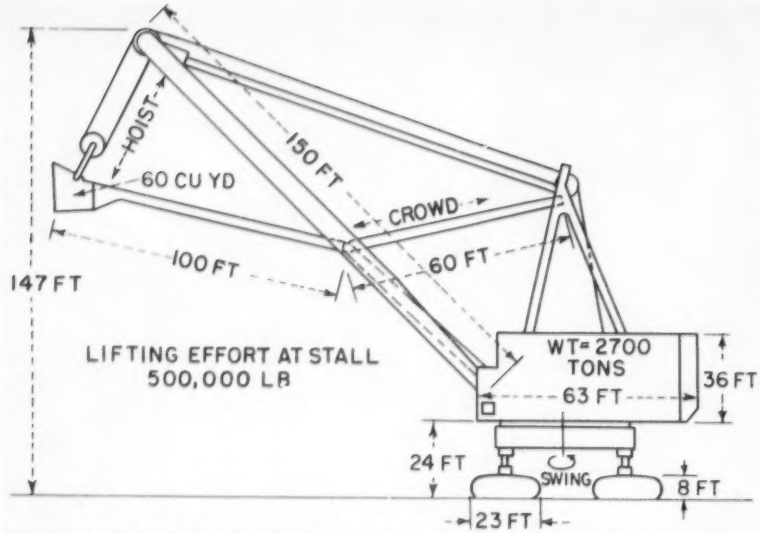


FIG. 2. PRINCIPLE DIMENSIONS of the "Mountaineer." The electric computer enabled design engineers to predict circuit performance of this huge unit accurately.

would stall the bucket and require a split-second decision to reduce power. This decision is made by the control equipment and heavy shock loads are no longer a cause of concern to the operator. This protective feature, as well as others, is automatic and saves wear and tear on the operator and machine. He is thereby free to concentrate on getting maximum production.

In designing generators and control equipment these automatic features as well as the size of each component had to be carefully studied. For example, components too small would not be able to stand the severe duty cycle, yet larger components are inherently slower in dynamic performance and would slow up the machine operation. So the final selection and design of components had to be a compromise between size and speed of response. Then too, while each motion is electrically independent, requirements of

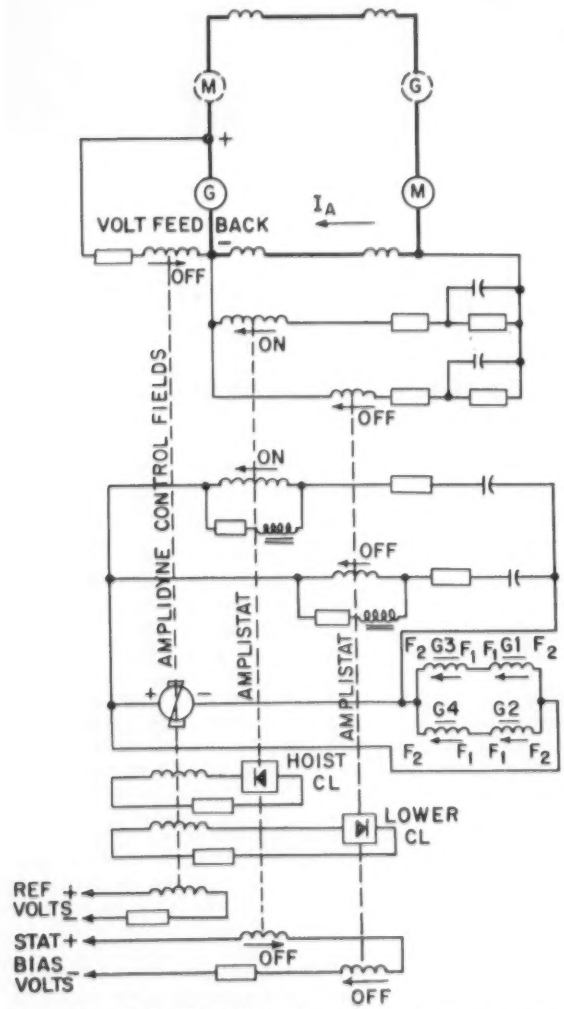


FIG. 3A. ELEMENTARY DIAGRAM of hoist motion. Amplistat circuit uses capacitors to prevent hunting action.

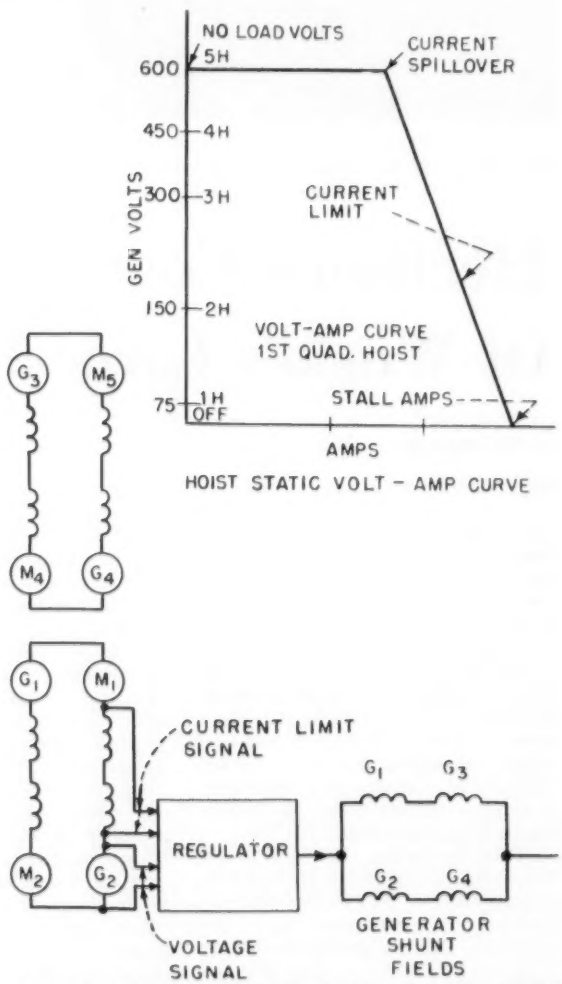


FIG. 3B. SCHEMATIC DIAGRAM OF THE HOIST CIRCUIT. New control circuit had never been tried before.

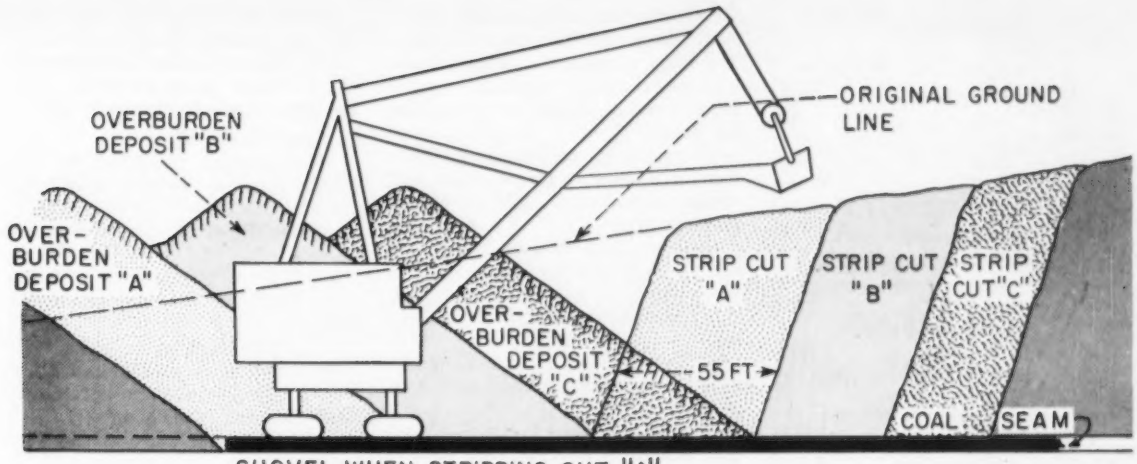


FIG. 4. SECTION through pit shows the type of job the shovel had to do. Compared with previous large shovel designs, bucket is 33% greater, reach and height range are 25% greater, increase in horsepower is 100%, and lowering speed is 180% greater. These large step-ups made design problems unusually difficult.

one are somewhat dependent on the response of another (hoist and crowd particularly); so the entire machine had to be designed as a whole.

What Was Studied On the Computer

Static requirements of the job serve as a target for a completely dynamic duty cycle consisting of rapidly changing torques with little changes in speed, rapidly changing speeds with little change in torque and simultaneously rapidly changing torques and speeds.

Motions studied and engineered on the electronic analogue computer were: **(a) Hoist, (b) Crowd, (c) Swing, (d) M-G set synchronous motor field control.**

Dynamic performance of each motion was engineered to obtain maximum transfer of energy in the shortest time consistent with the desired duty.

Why This Shovel Was Studied On the Computer

The computer study was required because dynamics of the system could not be calculated accurately by hand in a reasonable time.

The computer drew a graphic record of the results in the form of an oscillograph trace. As many as eight variables were plotted simultaneously. This feature alone saved rewriting and solving the differential equations eight times to determine eight different output quantities, such as motor speed, generator volts, generator armature amperes, amplidyne volts, amplistat volts, load torque and distance the bucket has traveled.

It was also possible to use an expanded time scale so that transient phenomena of a high frequency could be studied in "slow motion." For example, the computer study was set up so that a transient lasting a half-second on the shovel would last five seconds on the computer with no loss (very likely a gain) in accuracy.

Another valuable feature of the computer is the fact that equipment units were represented full size and not scaled down to model size. Thus chances of error resulting from overlooking some criteria of the "theory of models" was not present. Specifically, the reasons for the computer study were:

1. This was a complete departure from previous shovel designs. With a 33% increase in size over the largest existing bucket, 25% increase in reach and height, 100% increase in horsepower and 180% increase in lowering speed (280% of former models), design problems were difficult.

2. Conditions imposed in (1) above required design and development of larger hoist generators and hoist motors than any in use.

3. New regulating control circuits, untried on shovels before, were designed to meet the dynamic conditions of operation. In general, hoist and crowd controls are voltage regulators with voltage control obtained from the amplidyne alone. The hoist voltage regulator was designed with an open-loop gain to result in a system with a response of approximately one second. Stated another way, approximately one second after the operator starts to select a desired operating voltage (starts to position controller), the drive should be at more than 63% of the desired voltage. This response is adequate for power shovel hoist operation. A biased current-limit is obtained from two amplistats driving into two separate fields on the amplidyne (two for reversing). Anti-hunting is obtained from the amplistats by means of a capacitor-resistor circuit (see Fig. 3A).

The amplification obtained by the use of the amplistats permits maximum use to be made of "lead" signals and lead circuits so that current-limiting is obtained from rate-of-increase-of-current if the current is initially at a significant value.

Crowd motion needs to be faster-responding than the hoist motion. The crowd circuit has the same type regulating equipment as the hoist.

Swing motion accelerates and decelerates the large inertia of the upper frame, boom and dipper. Response of swing equipment to the operator must be controlled to provide smooth accelerations and decelerations. Current-limit is necessary to limit strain in the lower frame and boom resulting from accelerating torque.

4. "High response" amplidynes were proposed for hoist and crowd, to meet previously established criteria of performance in limiting current overshoot resulting from shock loads.

5. Large quantities of power required during transients plus the fact that the shovel was expected to operate on 15,000 to 20,000 ft. of trailing cable from a 5,000-kva substation dictated a change to a new higher voltage distribution system. Transient power peaks of large magnitude would have to be taken from the cable without objectionable voltage drop or pull-out of the 3,500-hp synchronous motor. Starting the M-G sets must be performed without dropping out the

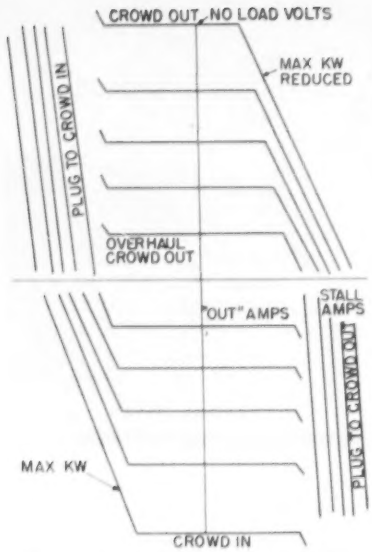


FIG. 5. STATIC CURVES above represent studies made of crowd action of the shovel.

ac undervoltage device. Consequently, open-pit power distribution was designed for 6,900v instead of the more customary 4,160v. This was another first as regards open pit mining power distribution.

6. In addition to 6,900v power distribution, the question of synchronous motor-field control under shock loads had to be studied. Magnitude and rate-of-change of load on the synchronous motor were obtained from the dc motors under impact conditions. These loads were applied to the synchronous motor and connected distribution system to check against the possibility of pullout under transient conditions. The loads applied required that special means be provided to keep the synchronous motor on the line at great distances from the substation. The study compared a voltage-regulator, power-factor regulator, and a block forcing scheme on the following points:

(a) Maximum possible cable length from substation before pullout with minimum diameter cable at normal system voltage.

(b) Test (a) above with system voltage 5% high and 5% low.

(c) Ability to catch first load peak.

(d) Synchronous motor field heating.

(e) Possibility of pullout on pumpback when plugging combined hoist and swing.

It should be noted that with 15,000 ft of rubber covered cable the ratio of resistance to reactance of the circuit is much higher than in conventional industrial plant circuits.

Circuit Constants Required

Certain machine and circuit constants were required before starting the study. Some of these constants are as follows:

A. Motors and Generators

(1) Static commutating limits throughout the voltage range.

(2) Saturation curves and load regulation.

(3) Time constants of all magnetic circuits.

(4) WK^2 of motor armatures, couplings, gears, drum, rope, bucket and dipper handle all referred to the motor shaft.

B. Amplidynes and Amplistats

(1) Voltage and commutation limits of "high response" amplidynes.

(2) Saturation curves for various combinations of quadrature axis series field and resistance.

(3) Magnetic circuit time constants.

(4) Control fields available. Number of fields and turns in each field.

C. Synchronous Motor

(1) Equivalent circuit of the synchronous motor including all transient values.

(2) Synchronous motor saturation curve.

(3) WK^2 of M-G set.

(4) Power distribution system constants:

(a) Minimum short circuit interrupting capacity at substation primary.

(b) Transformer rating and per unit resistance and reactance.

(c) Cable per unit resistance and reactance.

(d) Rate and magnitude of loading on the synchronous motor.

(e) Normal daily voltage fluctuation at substation primary during the day or night for which a tap change would not be made.

After the above data was obtained for the dc drives, the circuit constants and steady-state theoretical gains were hand-calculated to provide the desired static characteristics of volts versus amps from no-load volts to stalled motor. Following this, the block diagram for the system on current-limit was drawn and necessary transfer functions were included (see Fig. 6). From the block diagram, a Bode analysis (gain-frequency plot) was made to determine how to get optimum anti-hunting with the least possible decrease in response of the system at higher frequency signal inputs. The value of high frequency response can be seen in Fig. 7. The "inductive" signal across the commutating and pole face winding of the hoist motors

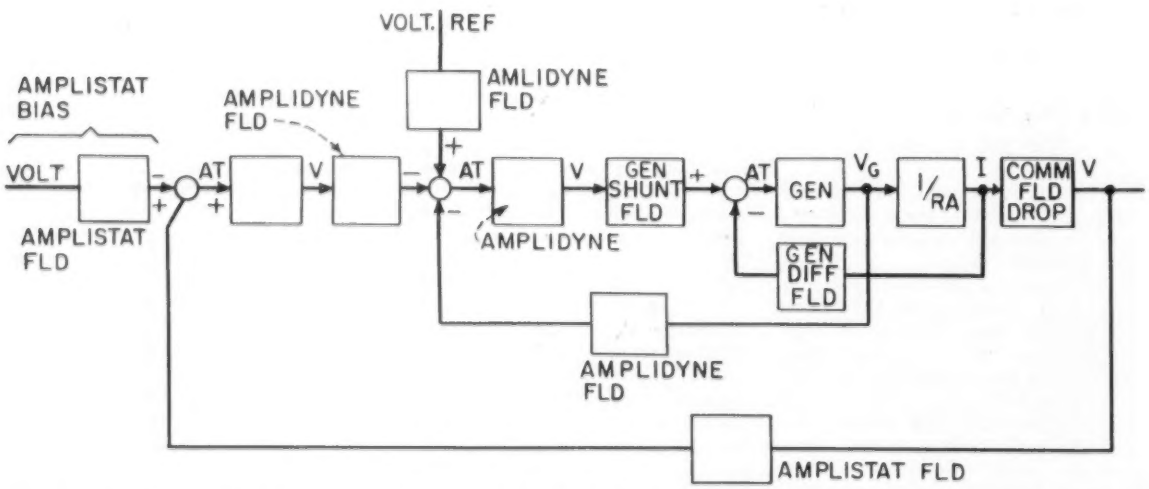


FIG. 6. BLOCK DIAGRAM of hoist the motion of shovel at stall. This condition occurs when the bucket strikes a rock ledge. It is usually the most severe shock loading or dynamic condition encountered by the power shovel.

and generators was actually measured transiently on the shovel simultaneously with armature current. It can be seen that the current-limit voltage actually appears as much as 0.04 to 0.08 sec ahead of the IR drop. If the system could respond to a signal coming on this fast, it would have a better chance of catching current overshoots resulting from impact loads at the bucket. The Bode analysis further indicated degree of stability margin available in the system and which direction to go to increase stability.

The Bode analysis also served as a check on the accuracy of the computer representation. The oscillation frequencies were predicted and checked against the computer. The system was deliberately made to hunt so that a correlation between Bode analysis and computer results could be obtained.

Bode diagrams are not a substitute for the computer but were utilized to make computer time more effective.

The synchronous motor field excitation schemes were also studied on the analogue computer. Again, design of a regulating system was developed on the computer to try to obtain the desired results with practical equipments available and reasonable power levels.

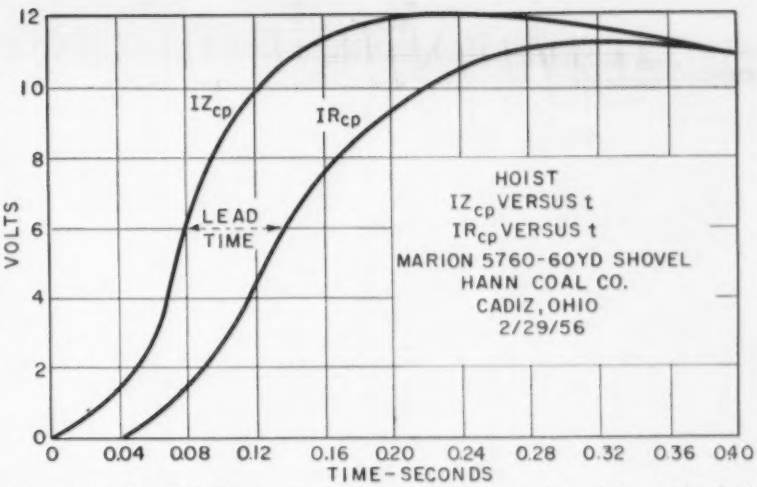


FIG. 7. CURRENT-LIMIT voltage appears as much as 0.04 to 0.08 sec ahead of the IR drop. This study revealed effects of impact loads on the bucket of the shovel.

High-Response Units Required

Application data obtained on the study of the hoist motion indicated that the "high response" amplidynes were necessary. On the computer the hoist drive was stalled rapidly with negligible current overshoot. Fig. 9 shows a fast stall actually measured on the shovel and the overshoot is small.

The study of the crowd motion gave similar results to that of the hoist.

The normal swing circuit was modified on the computer to include an added feature of backlash take-up so that "plugging" the drive provides still smoother deceleration.

Additional data obtained from the computer included:

1. Time to accelerate the bucket from rest to top hoisting speed for empty bucket and full bucket.
2. Control of plugging peaks when plugging from top speed lowering to top speed hoisting.
3. Effect on system performance of operating the shovel at minus 20 deg C.
4. Effect of substituting high frequency amplistats in place of 60 cycle per second amplistats.
5. The distance in motor revolutions that the hoist moves past the point where the controller is plugged from full lower to full hoist conditions.

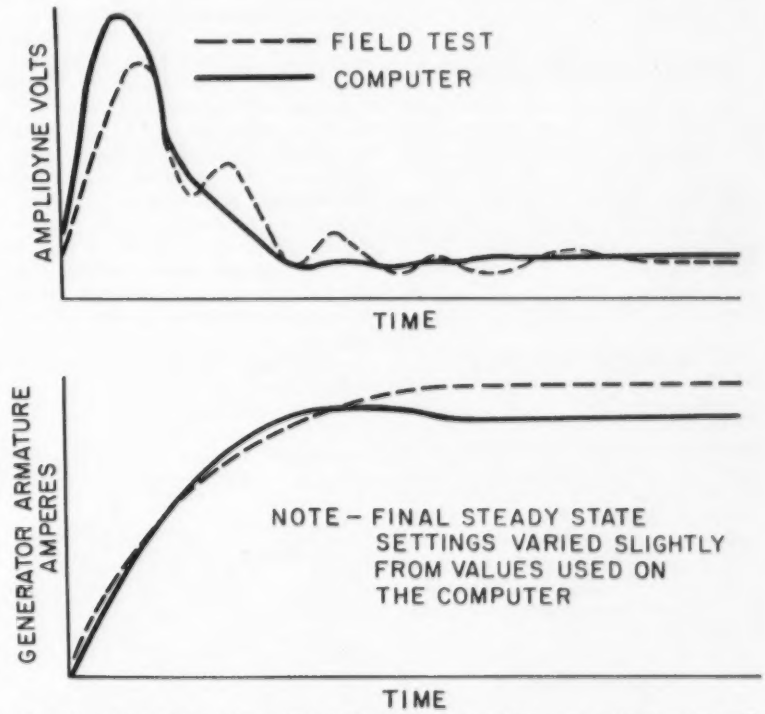


FIG. 8A. Heavy line (determined with computer) predicts very reliably what will actually happen when voltage and current are determined in field tests.

The computer study was conducted using calculated design data. From the results of the study, specifications were written considering the dynamic requirements and their effect on steady-state design. These specifications were based on data obtained from the study such as:

a. Peak-load magnitude and frequency.

b. Duration of loads.

c. Design of magnetic-energy circuits and response to exciting systems.

d. Effect of discontinuous functions operating in magnetic circuits.

e. Optimum stabilizing of regulating circuits.

f. Effect of damage to regulating circuits.

g. Provision for accommodating manufacturing tolerances.

After manufacture and assembly, factory tests were conducted to confirm the calculated constants of the

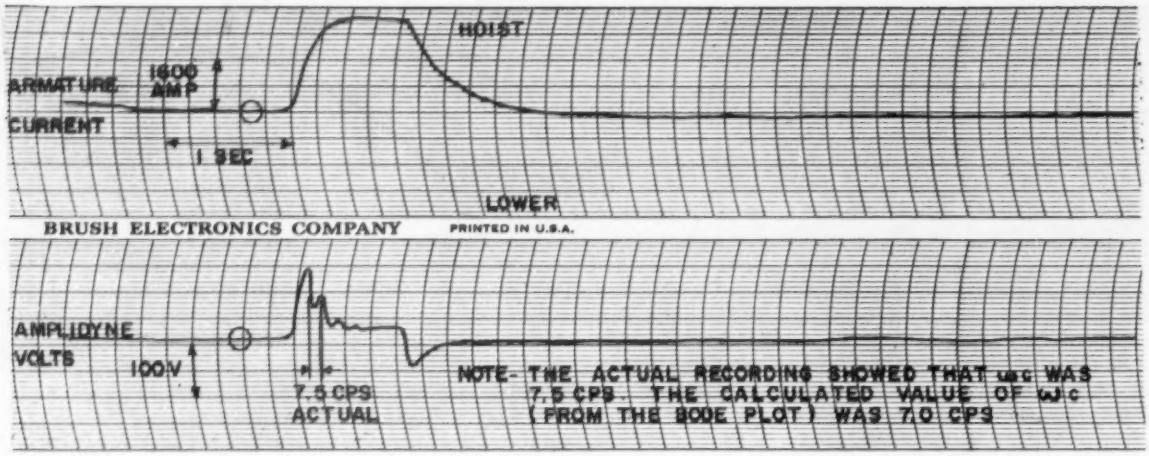


FIG. 8B. Inking oscillograph record of generator armature amperes and amplidyne volts recorded simultaneously. The actual recorded values under operating conditions checked calculated values very closely.

rotating machines and operation of the controls.

Practical Results Achieved

The computer representation utilized functions rather than devices. For example, a generator is represented as a saturation curve and a field time constant. Thermal capacity, commutating limits and shaft sizes are not considered on the computer. These latter factors must be considered to manufacture a generator and are influenced by the computer results.

Rotating Machines

Shovel generators are specially designed for this service. As previously mentioned, wherever dynamic requirements affected the mechanical or electrical design of the machines, the computer results were used as the basis of writing the specifications. For example, the generator shunt-field turns and resistance were determined by dynamic requirements on the analogue computer.

Control Design

Initially, an elementary diagram was designed to be used as the basic circuit for the computer diagram. This elementary diagram provided the steady-state functions of:

a. Voltage-regulator with current-limit.
b. Reversing operation.
c. Motor field control.
d. Suggested anti-hunting.
e. Provision for absorbing pump-back power.

Circuit gains on the preliminary elementary diagram were hand-calculated based on experience with other systems using a similar type of control.

From results of the computer study component sizes required to meet dynamic duty were established. Anti-hunting of regulators was optimized. Final control-resistor settings, relay sequence and timing and necessary back-up protection of circuits was established. The final elementary diagram was then designed converting the computer functions to "real life" devices such as amplidynes, amplistats, relays, resistors and rectifiers with voltage and current ratings and thermal capacities, keeping in mind the severe conditions of shovel duty, such as:

a. Mechanical shock and vibration.

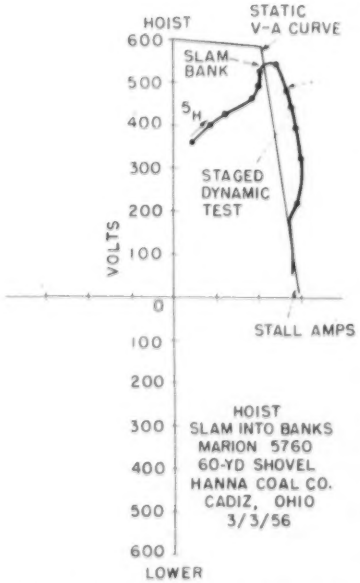


FIG. 9. ACTUAL DYNAMIC STALL of the hoist motor during digging operation.

b. Variation in ac voltage supplied to the shovel, especially low voltage accompanied by mechanical impact.

c. Adverse atmosphere of dirt, rock dust and coal dust.

d. Ambient temperatures ranging from 104 deg F in summer to —20 deg F in winter.

After manufacture and assembly the control panel was tested and shipped with all settings preset at the factory as indicated by the computer study.

Field Results Check Computer Predictions

At the initial tuneup of the shovel, all parts were assembled to work as a complete system for the first time. Steady-state gains were checked against the gains used on the computer and adjusted to agree. Stability and transient performance were checked with an inking direct-writing oscillograph (see Fig. 8A and 8B for comparisons of computer and field tests). It was noted that factory preset control-resistor settings were in most cases within 10% of the final field setting.

The electronic analogue computer proved to be a valuable tool in the design of the electrical equipment for this large power shovel. Its use reduced the time and expense of obtaining the data necessary to intelligently design the many interrelated components, and contributed immeasurably in obtaining the optimum performance from the system.

Acknowledgement is hereby made to the Marion Power Shovel Co., Hanna Coal Co. and groups in the General Electric Co. whose cooperative efforts made possible the type of study described here.

PRESIDENT Sidney Lieberman and mine superintendent "Red" Howell discuss a problem at the new mine adit.

DISCOVERER William Mania (right) found radioactivity first on old iron mine dumps. Walter S. Newman is at the left.

Eastern Uranium Mine Prepares to Ship Product

THE ONLY URANIUM MINE east of the Mississippi River with an Atomic Energy Commission contract to purchase concentrates is moving toward shipment.

Ramapo Uranium Corp., whose offices are in New York City, is mining magnetite and uraninite from some old iron mines near Warwick, N. Y., about 60 miles northwest of New York City. The discovery lies in an area 2½ miles long by one mile wide, with three nearly-parallel radioactive zones in evidence.

Radioactivity is found in lean magnetite on the footwall side of the contact between granite rock and magnetite veins. Uraninite occurs in and around pyrite. The magnetite outcrops or lies shallow in the overburden, runs 5 to 15 ft in width.

First discovery was made by William Mania, a prospector from New Jersey who "likes to walk." Mania tramped over the hills around Warwick with a counter for many months before he encountered a spot where the machine "acted like something was broken."

While radioactivity is extensive in the old iron seams, Ramapo's president, Sidney Lieberman, is the first to say that his company has a lot to learn about the deposit. His company is probing the old iron mine shafts and cavings where Mania made his original discovery and driving an adit toward the footwall contact in one mine. It was in the dump of this property, the Miles Standish mine, that Mania found samples which assayed up to 1% U_3O_8.

Uranium-bearing lean magnetite reportedly runs 0.05 to 0.15% uranium oxide, with assays of up to 1% occurring in pockets. Some 25,000 tons of ore has been proven by mine superintendent Richard Howell and his crew. Miners were recruited from New Jersey and New York.

To date, some $250,000 has been expended by the company on the 580-acre claim and the pilot plant at Warwick. The pilot plant has been in operation for several months, turning out a concentrate averaging from 50 to 86% U_3O_8. So far, no concentrate has been delivered under the AEC contract which provides for purchase of up to 50,000 lb at $8 per lb.

OUTCROPS all along the strike of magnetite show uranium content.

Pilot plant uses a dry grinding technique, followed by air separation and magnetic cleaning which yields a barren sand, an almost barren high grade fine iron ore (plus 40 mesh) and a high grade uraninite and pyrite concentrate.

Ramapo Uranium will have a new mill operating in August to handle some 300 tpd ore. Mill is located on the mine site and will differ from the pilot plant procedure in that crushing will be wet, as will jigging. Final concentrate will be a product of air separation. Crushing will be by one jaw crusher and one roll. Magnetic separators are being installed.

Separation of magnetite from uraninite and pyrite is done simply and Ramapo is basing a good part of its future on the sale of by-products. So far, according to Lieberman, the company has found good markets for the magnetite and sand.

The company has progressed rapidly from the date when it leased Mania's discovery. The adit into the old iron mine which was the site of the first find is now in some 300 ft and two raises will be completed shortly. Testing and assaying go on constantly in what Lieberman calls "a slow, but steady" move toward capacity. The front end loader which was mucking in the adit will soon be replaced by an air locomotive and track.

Concentrate produced for the AEC will be shipped to the plant at Fernald, Ohio operated by National Lead Co.

FLIN FLON, Manitoba, where Hudson Bay Mining & Smelting Co. smelts 880 tons of copper concentrate, necessary silica flux and about 280 tons of zinc plant residue a day. Hudson Bay treats all the reverberatory slag to recover the zinc.

How Hudson Bay Fumes Reverb Slag

R. E. MAST
G. H. KENT

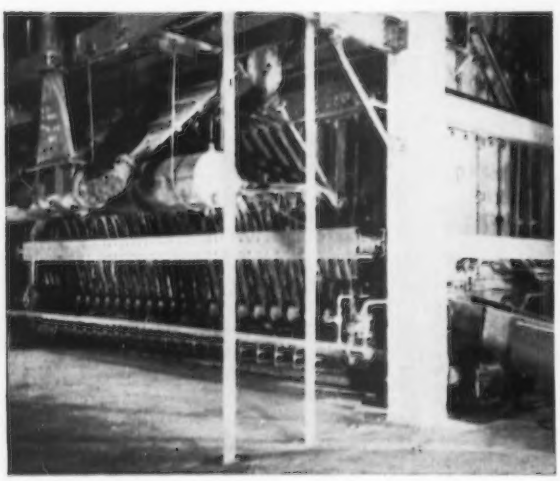
SINCE 1951, the world's first copper reverberatory-slag fuming plant has been recovering zinc successfully from copper reverb slag at the rate of 82 tpd. Starting from slag, running about 8% Zn, Hudson Bay Mining & Smelting Co., Ltd., (HBM&S) recovers better than 88% of the zinc as oxide fume which is treated in the electrolytic zinc plant for recovery of slab zinc.

Mr. Mast is smelter superintendent and Mr. Kent is assistant smelter superintendent, Hudson Bay Mining & Smelting Co., Ltd., Flin Flon, Manitoba.

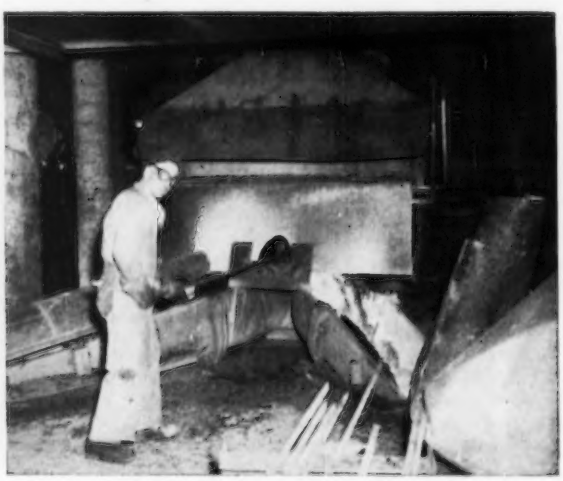
In addition, considerable matte is reclaimed by settling before fuming this slag. Furthermore, slag fuming has indirectly increased ore reserves at Flin Flon, Manitoba, by allowing the company to recover more metal per ton mined. Reserves now stand at approx 15-million tons within trucking distance of the smelter. And, Hudson Bay is steadily building reserves in the Snow Lake area.

This fuming plant was designed on basis of experience gained at Flin Flon; Consolidated Mining & Smelting Co., Trail, B. C.; Bunker Hill Co., Kellogg, Idaho; and American Smelting & Refining Co., El Paso, Tex.—an outstanding example of industry cooperation. Exchange of ideas and data between these companies played an important part in Hudson Bay's success.

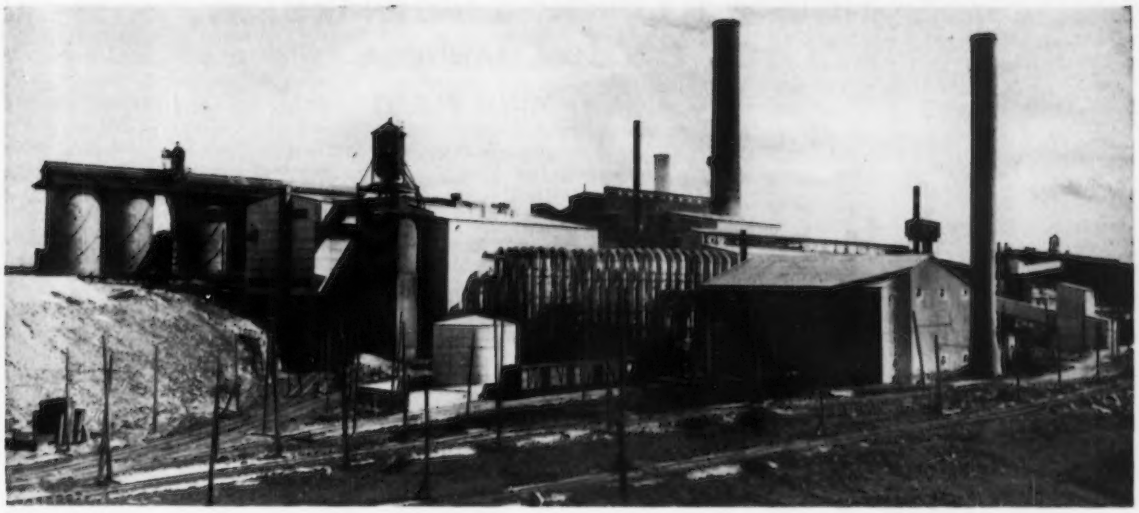
The method was proposed, piloted, developed and put into practice at Flin Flon. HBM&S handles all the daily slag production in a plant that will be described in detail below. It includes two holding furnaces (from which matte is recovered), two fuming furnaces, waste heat boilers, fume cool-



FUMING FURNACES are 8 ft wide by 21 ft long with three water-cooled tuyeres in each bottom side jacket.



FUMING FURNACES are tapped into two slag trains. Operator switches movable launder section to fill each pot.



ZINC FUMING plant treats all the daily reverberatory slag in the plant and recovers more than 30,000 tons of zinc-in-fume per year. Recovery is better than 88% on 8% Zn slag. Process also recovers 2,000 tons of matte per year.

ing-towers and baghouse dust collector. Fume collected goes to electrolytic plant where it is converted to slab zinc.

Holding the Slag

Holding furnaces are identical in design, one serving each fuming furnace. They are 26-ft 6-in. long by 11-ft 6-in. inside width. Side walls are 24-in. thick bonded magnesite. Originally, wall was 9-in. magnesite, 9-in. fire-brick and 6-in. insulating brick on the outside. After about six months' operation, the 9-in. magnesite smelted away at the slag line, leaving no support for the upper portion.

During the repair program of 1953 on one holding furnace, the upper 24 in. of the side walls above the slag line were replaced with 70% alumina brick.

The sprung roof arch is 12 in. of super-duty firebrick; the skewback brick being supported by an angle irons attached to the buck stays on both sides of the furnace. The furnaces bottom is an inverted arch, 24 in. thick, composed of 12 in. of magnesite backed with 12 in. of superduty firebrick. The arch is laid in a bed of castable refractory material.

Three 24-in. dia. carbon electrodes, held in water-cooled clamps, supply the power. Electrodes are obtained in 72-in. lengths, weighing about 1,800 lb each, with a threaded socket to each end. Sections are held together by a graphite nipple and a joint-cement, and fed into the furnace. As electrodes are consumed, new sections are screwed in place and made ready.

Equal distribution between the electrodes is maintained by an amplidyne system, with transformer equipped to produce secondary voltage from 130 to 270 v in 10v steps. This voltage permits very shallow electrode immersion (with occasional arcing) and prevents smelting out the furnace bottom. At lower voltages, the electrodes have to be too deeply immersed to maintain the load.

Slag is tapped from one side wall through a cast steel tapping plate with a water-jacketted 5-in. hole. Slag goes by heat resistant cast-iron launder into the fuming furnace. Slag hole is then closed by a wet clay dobie, and the slag hole is prepared for opening by driving a green spruce pole through the wet dobie. Pole moisture freezes a hole in the slag that requires less chipping and burning than when you try to cut your way through 24 in. of frozen slag.

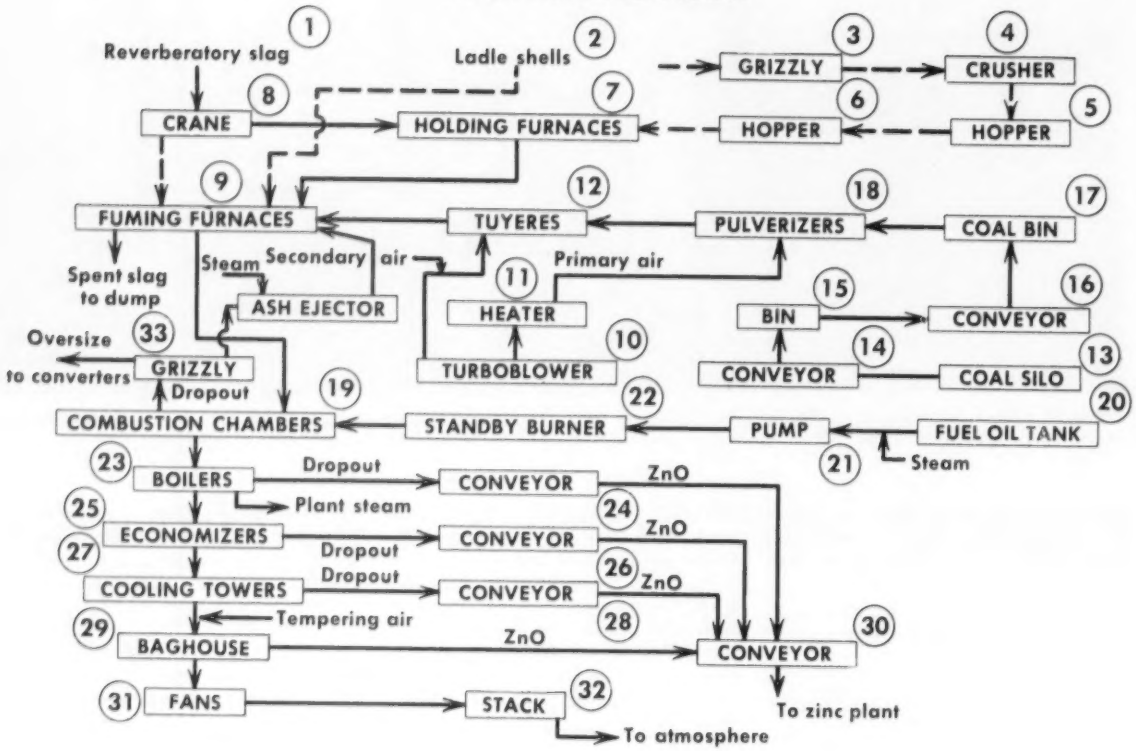
Slag holes are hooded and vented to an exhaust fan to remove fumes during tapping. The furnaces are also vented to the atmosphere by a steel stack extending through the fuming roof. The horizontal section of this flue has a water-cooled screw conveyor to return any zinc oxide present to the holding furnaces.

HOLDING FURNACES are tapped direct to the fuming furnaces. Normal charge is 74 tons. Matte is tapped periodically and sent back to the converter floor.

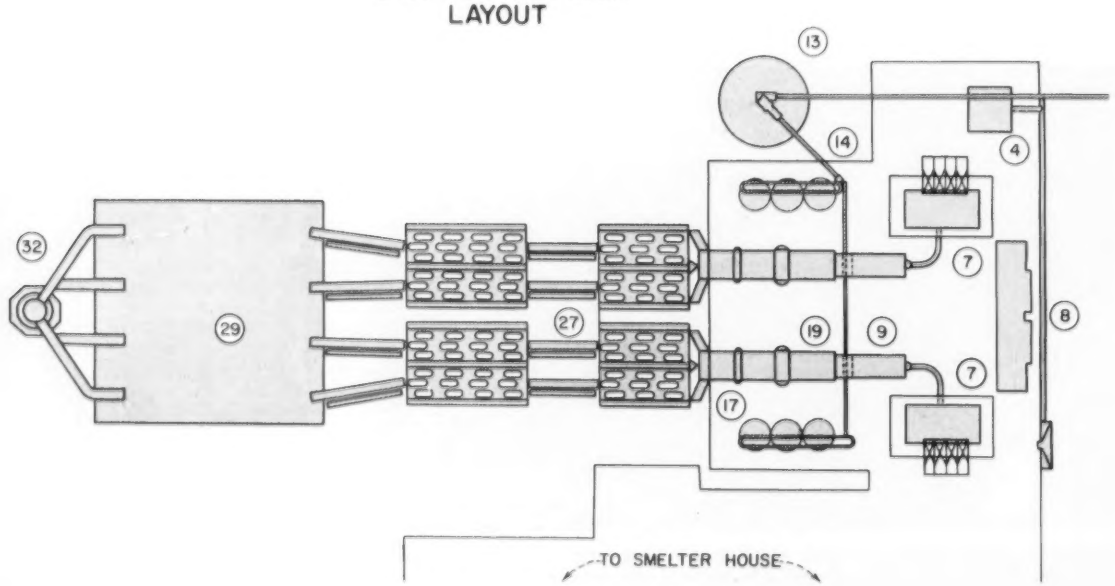
Matte Is Recovered

Approximately 2,000 tons of matte are tapped out and recovered from the holding furnaces per year. This material is tapped out through an end wall and sent to the converters. Should the holding furnace be out of action for any reason, slag can be charged directly to the fuming furnace through

HUDSON BAY MINING & SMELTING CO., LTD.,
FLIN FLON, MANITOBA
ZINC FUMING PLANT



HUDSON BAY MINING & SMELTING CO., LTD.
FLIN FLON, MANITOBA
ZINC FUMING PLANT
LAYOUT



the emergency charging spout. This procedure has little effect on fuming, but the copper content is lost.

Ladles are shelled on every trip so that the bottoms do not get too heavy. These shells are crushed if necessary in a 12-in. gyratory crusher and sent into the fuming furnace through the emergency charging spout. Occasionally, some shells are melted in the holding furnaces.

Cooling the Fuming Furnaces

Fuming furnaces are each 8 ft wide by 21 ft long inside, and 24 ft high with the top rising another 17 ft to enter the water-jacketed combustion chamber. Fuming furnace water jackets have ½-in. flange-quality plate on the fire side and ⅜ plate on the outside. Each jacket is 6 in. thick with studs welded on the fireside on 6-in. centers. This supports the protective slag shell during tapping and reduces the thermal shock on the jackets.

The water-cooled furnace floor has seven jackets made of 2-in. double extra-heavy-duty pipe with ¾ x 5-in. steel strap set on edge between pipes. Mortar of ground magnesite brick and water was troweled ¾-in. deep over the pipes and dried with a wood fire.

Bottom row of side jackets is 4 ft 8¼ in. high and tapered. Jackets are 13⅜ in. thick at the bottom and 5⅞ at the top, giving the furnace a 7½-in. bosh on either side. In addition, the water-cooled tuyeres extend and additional 7¾ in. beyond the jacket face.

There are three tuyeres to each of the seven bottom side jackets on each side of the furnace. They are water-cooled and located about 10 in. off the floor.

Cooling water, at the rate of 3,500 to 4,000 gpm, enters each furnace at the bottom of the jackets and flows out at the top into collecting pipes. Temperature rise is about 22 deg. F. Cooling water comes from the plant mains through 14-in. line to a 40,000-gal. storage tank. From here, water requirements for each furnace are drawn through 10-in. lines.

Effluent from one furnace enters a sump and gravitates to the plant circuit, while effluent from the other furnace enters a 12-ft dia by 10-ft wooden tank. Most of this water returns to the large storage tank through a 10x8-in. Allis-Chalmers pump. Excess over pump capacity returns to the plant circuit by gravity flow. All water rates are recorded for each furnace on Bailey flow recorders.

Providing Air and Coal

Tuyere air is supplied to each furnace through centrifugal blowers powered by 700-hp, 1,800-rpm electrical motors with gyrol fluid coupling and speed increasers. Maximum blower speed is 8,400 rpm and their capacity is 10,000 cfm and 12.5 psi.

HBM&S can draw on a supply of converter air should fuming plant blower air drop below the critical point.

One blower serves one furnace with the air split into two parts: primary and secondary. Primary air makes up about 45% of the total feed, enters the coal pulverizers and blows the coal into the furnace. Secondary air enters at the tuyeres at slightly higher pressure to insure against blow back.

Coal for the fuming furnaces is ground in two of three Type E-29 Babcock and Wilcox unit pulverizers at each furnace. The third is a standby and can replace either unit. Since the primary air must push the coal through a static head of molten slag, the raw coal tanks are held under the same air pressure.

This is done through an air-tight two-compartment steel tank set above each pulverizer. An air-tight cone-shaped valve separates the two compartments. Coal enters the top and is put under pressure while the lower one is sealed. When the top is full and pressurized, the middle valve opens and drops the coal into the bottom hopper.

Coal, delivered by rail, is stored in a 700-ton bin in the fuming plant. Coal is drawn as needed over a Merrick Feed-O-Weigh to a Redler elevator that discharges to a Redler run-around conveyor over the three pulverizer coal bins at each furnace.

The entire coal handling unit is operated by remote control from the control room in the fuming plant. Warning signals indicate that coal feed tanks are empty or low. Automatic controls take over and fill the tanks, pressurize them and open the valves to feed the pulverizers.

LEGEND

1. Reverberatory slag runs approximately: Au—0.004 oz, Ag—0.114 oz, Cu—0.44%, Zn—8.17%, Pb—0.23%, SiO_2—34.7%, Fe—31%, Al_2O_3—5.4%, MgO—2.8%, CaO—1.6% and S—1.8%
2. Ladles are shelled on each trip and shells charged to fuming furnaces. If too heavy they are crushed and sent to holding furnaces
3. Grizzly ahead of the crusher
4. Traylor gyratory crusher, 12-in.
5. Crushed slag hopper
6. Holding furnace hopper
7. Two, 2,000-kva Lectromelt furnaces, one to each fuming furnace. Matte is tapped periodically and sent back to converters
8. Two 40-ton Provincial cranes for ladle service
9. Two 8x21-ft fuming furnaces, coal-fired. Take 74-ton charge
10. Three Turbo blowers, one to each fuming furnace and one on standby. Blowers delivers 10,000 cfm at 12.5 psi, have 700-hp electric motor. Gyrol fluid coupling and speed increaser permit blowers to turn over at maximum 8,400 rpm
11. Preheater for primary air
12. Each fuming furnace has 21 tuyeres to each side
13. Fuming plant raw coal storage bin
14. Belt conveyor to coal bin at fuming plant
15. Coal bin, 700-ton capacity
16. Redler elevator and Redler run-around conveyor
17. Three pulverizer coal bins to each fumin furnace. Bins are air-tight and under 12.5 psi
18. Three Babcock & Wilcox Type E-29 pulverizers, one to each furnace. They grind coal to 90% minus 200 mesh with third on standby
19. Combustion chambers, where oxidation of the zinc is completed. Heavy particles that settle out are collected in hopper for return to fuming furnace by steam injector
20. Standby burner fuel oil tank
21. Oil pump
22. Standby burners for combustion chambers
23. Waste heat boilers to produce 400-psi steam for plant use
24. Screw conveyor takes settled oxide from boiler to oxide conveyor 30
25. Economizers to preheat feed water for boilers
26. Screw conveyor takes settled oxide to oxide conveyor 30
27. Cooling towers of 38-in. dia U-tubes, air cooled
28. Screw conveyor takes settled oxide to oxide conveyor 30
29. Northern Blower baghouse with eight arresters arranged in pairs lengthwise over a balloon hopper. Bags are 6-in. dia by 99-in. long with about 12 sq ft cloth area. Total cloth area 104,832 sq ft. Average gas flow is 134,000 cfm at 200 deg F. Maximum temperature permitted with mixed Dacron and Orlon is 250 deg F. Efficiency is better than 99%
30. Oxide conveyor delivers oxide collected in boilers, economizers, cooling tubes and baghouse to the zinc plant where oxide is recovered as slab zinc
31. Two No. 70 Northern Blower draft fans maintain furnace draft on each unit. Capacity to deliver 38,000 cfm at 200 deg F and 9-in. water pressure
32. Flue stack is 10x65-ft steel construction, vents cleaned effluent to atmosphere
33. Dropout from combustion chamber worked through 2-in. grizzley and returned to fuming furnace via steam injector

A system of bustles and splitters in the line provides equal distribution to each tuyere. These tuyeres are of the double inlet type with primary air and coal mixture entering the tuyere inlet nearest the furnace. Secondary air enters behind this inlet at a slightly higher pressure to prevent blow back. Between the two inlets, a small Venturi throat insures that coal will not blow back when the tuyere is punched.

Total air flow is controlled by a Bailey flow controller on each blower. Through this device, one can maintain any desired air flow by varying pressure in the gyrol coupling to change blower speed.

Primary air is controlled through a piston-operated damper acutated by a Bailey flow controller. There is a damper on the secondary air, but it's seldom touched. The primary air is automatically controlled, so any change shows up in the secondary line. Rate of coal delivery is changed by altering the rate of primary air flow.

Original design included tertiary air ports to introduce additional air above the slag for complete oxidation of the zinc fume. However, HBM&S has never found it necessary to use these, since sufficient air enters through the charging spouts.

Boilers Collect Some Oxide

Fume-laden gases pass from the fuming furnace to a water-cooled combustion chamber where the zinc fume is completely oxidized and any heavy particles settled out. These heavies are collected in hoppers at the bottom of the chambers while fume enters the waste heat boiler, passes through a series of 38-in. dia U-tube gas-coolers and enters the baghouse.

Water-cooled screw conveyors remove any oxide settled in the boilers to a conveyor for delivery to the electrolytic zinc plant.

From the air-cooled U-tubes, dust enters the baghouse. Any oxide dropping out in the tubes is collected in hoppers and passed by screw conveyor to the oxide conveyor and sent to the zinc plant.

The boilers, through which the fume passes, have a superheater, boiler and an economizer section. HBM&S preheats and deaerates feed water before it enters the economizers. Make-up water is softened with Zeolite.

In the economizers and boilers, soot is blown automatically six times a day, using superheated steam. Sometimes this schedule is varied to adjust baghouse temperature. Blowers in the superheaters are used only as necessary to maintain desired superheat.

Steam from boilers is delivered to power house to produce plant heat. Part of the steam drives a standby turbine generator that feeds power to the plant circuit. In the event of a power failure the fuming plant is automatically isolated, with this generator supplying power for the essential machinery in the fuming plant. Normally, power comes from Island Falls hydro generators.

Towers to Cool and Collect

Gas cooling towers are hand hammered with wooden mallets every few hours to knock down oxide accumulation and to vary the cooling rate in the tower. Amount of cooling done in the towers can be controlled to some extent by a by-pass system and by the hammering. Atmospheric air admitted automatically between the towers and the baghouse inlet tempers the air to maintain 250 deg F.

Baghouse Recovery Is High

Baghouse fume is collected in eight No. 1092A Northern Blower dust arresters arranged lengthwise in pairs over 4 balloon hoppers. Cleaned effluent gas goes through the induced-draft blower and to atmosphere through a 10x65-ft steel stack.

Each arrester has 14 compartments, each containing 78 bags so that the whole baghouse has 8,736 bags or 104,832 sq ft of cloth. Average gas-flow through the baghouse is 134,000 cfm at 200 deg F, with solids-loading about seven grains per cubic foot. Collector efficiency is high—over 99%.

Bags are rapped pneumatically every 16 min without reverse air. It was found that allowing atmospheric air to blow back through the bags during rapping period caused the bags to collapse and increased wear rate on the bags.

Bags are left in service until they show signs of wear. Then, they are taken down, cleaned, patched and sewn as necessary. Originally, wool Melton cloth was used, but it deteriorated rapidly and has now been replaced by synthetics. Continuous trials are now being made on several types and weaves of bag materials. Nylon proved to be useless, while Orlon and Dacron have shown a service life of over 18 months.

Fairly light, napless material is best. Initial permeability does not appear to be critical. It was found that a range of 45 to 110 cfm per sq ft at 0.5-in. water pressure across bags was satisfactory.

At each furnace, draft is maintained by two No. 70 Northern Blower fans, each capable of delivering 38,000 cfm at 200 deg F and 9-in. static water pressure. They run in relatively clean air, but need attention due to zinc oxide accumulation. Fans are equipped with dampers to maintain constant draft at the waste heat boiler inlet and to divide the air-flow evenly between the two fans on each furnace.

Plant can operate for short periods with one fan shut down.

All the oxide outlets from the boilers, economizers, cooling tubes and baghouse hoppers are air-tight flap or star valves. The oxide collected from these points goes by conveyor system to the zinc plant where it is recovered as slab zinc.

HBM&S handles all reverberatory slag production with better than 88% of the contained zinc recovered. In addition, they also recover several thousand tons of valuable matte from the holding furnaces each year.

How the Fuming Plant Is Operated

Fuming is scheduled by availability of slag from the reverberatory. At the beginning of a shift, an estimate is made of the amount of slag that will be available during that shift, using as a basis, depth of slag in the reverb, amount of calcine to be smelted and converter schedule. Slag is tapped at uniform schedule. Normally, two pots, or about 37 tons of slag are tapped from the reverb at any one time.

Regular fuming furnace charge is 74 tons (four ladles). When fuming plant operators know the amount of available slag, they decide how many charges to make in the two furnaces. This is based on the amount of slag in the holding furnaces as well as the amount expected from the reverb. For example, if 22 ladles are to be received, the operator may decide to make six charges of four ladles each, dropping the holding furnace by two ladles, or make five charges and let the holding furnaces increase by two ladles.

Fuming and Tapping Time

Thus the cycle time for each charge is fixed to have continuous operation. As soon as one charge is tapped, another is started. The two furnaces are operated alternately so that when one is being tapped, the other is in the middle of its fuming cycle.

Before tapping, two slag trains are positioned with a total of seven side-dump pots. Two 5-in. tap holes on fuming furnace are opened and slag runs alternately down one or the other of two launders (by switching movable section). One train moves the next pot into position, while a pot on the other train is being filled.

Usually from a four-ladle charge,

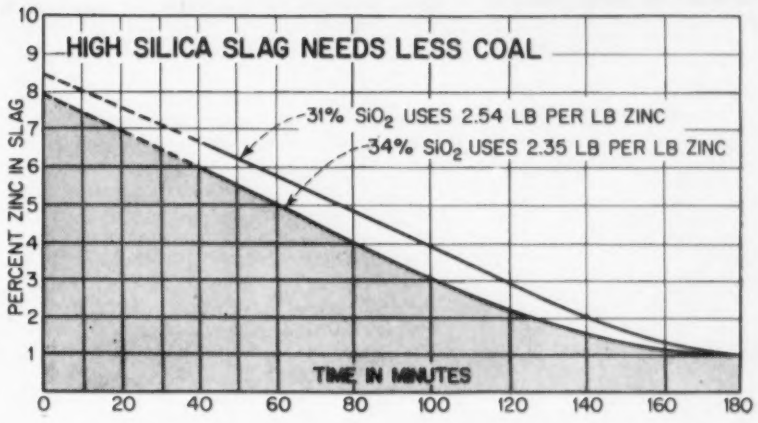
five to seven pots of spent slag are obtained. If the seven pots do not empty the furnace, the holes are closed off and the furnace recharged for the next cycle or left until more pots are available. Usually, the furnace is completely drained, and the holes are plugged with clay dobies and clamps swung in behind the dobies. When this is done, the slag hole in the holding furnace is opened, and charging for the next cycle is begun. The proper amount of slag for a charge is determined by the back pressure at the tuyeres as indicated in the control room, and the difference in level of the slag bath in the holding furnace.

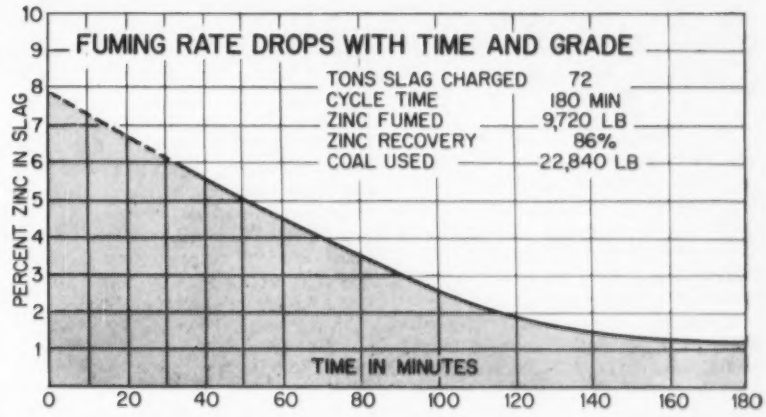
During charging, the coal feed rate is gradually raised from 90 to 100 lb per min, to about 150 per min when the furnace is fully loaded. The ladle shells from four ladles of slag are charged through the emergency charging spout, and charging is complete. The charge is fumed, using 10,000 cfm of air and the 150 lb of coal per minute, for as long as the schedule will permit. Tuyeres are occasionally punched with a ¾-in. rod to keep them clean. About 15 to 20 min before tapping time, the coal is gradually lowered to 90 to 100 lb per min. This allows the charge to heat up, makes the slag more fluid and cuts down frothing so that it will fill a minimum number of slag pots.

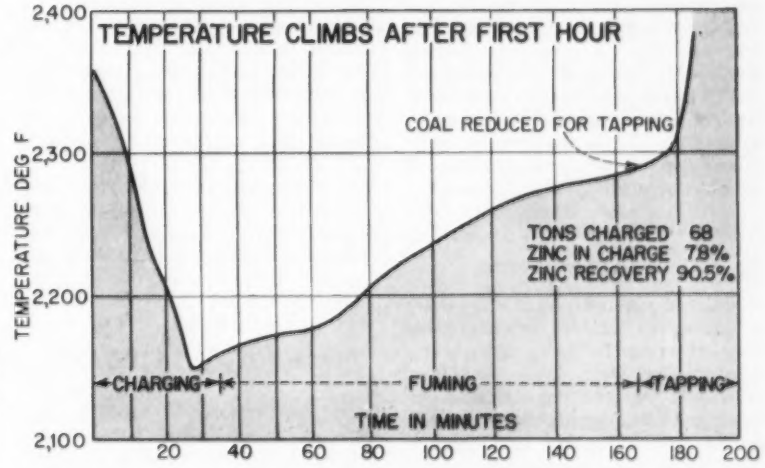
Complete cycle time is about 180 min of which 20 to 25 min are charging time, 15 to 20 min at low coal preparatory to tapping, and 15 min at low coal and tapping out.

When one furnace is out of service, the entire tonnage of smelter slag is treated in the other furnace, at much shorter cycle times. The recovery is then about 60 to 70%; the pounds of coal per pound of zinc about 1.8; and the zinc fumed per minute about 70 to 80 lb (see table to compare with normal operation).

Slag temperature in the fuming furnaces is controlled by changing the coal fed to the tuyeres. Under normal conditions, lowering the coal will cause the temperature of the slag to increase, due to a greater portion of the air being used to form CO_2 instead of CO in the slag bath. Temperature at the boiler entrance will decrease, however, with a lowering of coal feed.


HIGH SILICA SLAG NEEDS LESS COAL
31% SiO2 USES 2.54 LB PER LB ZINC
34% SiO2 USES 2.35 LB PER LB ZINC
PERCENT ZINC IN SLAG
TIME IN MINUTES
0 20 40 60 80 100 120 140 160 180
1 2 3 4 5 6 7 8 9 10


FUMING RATE DROPS WITH TIME AND GRADE
TONS SLAG CHARGED 72
CYCLE TIME 180 MIN
ZINC FUMED 9,720 LB
ZINC RECOVERY 86%
COAL USED 22,840 LB
PERCENT ZINC IN SLAG
TIME IN MINUTES
0 20 40 60 80 100 120 140 160 180
1 2 3 4 5 6 7 8 9 10



Silica Content Is Important

Percentage of silica in the slag increases as zinc is eliminated, so that a charge will react differently at the start than it does after the zinc is removed.

Slags of over 40% silica are almost impossible to fume. Thick shells of frozen slag are formed on the furnace walls, and the charge is very viscous. Large blobs of slag are thrown out through the emergency charging spout, and the fuming furnace vibrates dangerously. Usually the thick shells fall into the charge, cooling the slag, and making it more viscous. Eventually the coal and air introduced at the tuyeres merely blows through the thick slag, and no circulation of the slag is obtained, and no fuming. The coal will also blow back at the tuyeres when they are punched, and blow out from the cracks between the jackets below the slag line. The coal splitters and bustles may ignite.

The usual procedure with such a charge is to add a ladle of converter slag, which assays about 25% silica, to reduce the silica content of the whole charge. If circulation can be restored, the charge can eventually be tapped out. Otherwise the coal is

turned off and the charge allowed to freeze. It must then be removed from the furnace by means of pavement breakers, a job which usually takes four or five days.

Slags from 36 to 38% silica are probably the cheapest to treat from the point of coal cost. They are difficult to handle however, and it is necessary to watch them very closely, and lower the coal to produce heat whenever they appear to be getting too cold. Conditions can usually be determined visually at the emergency charging spout, or by noting the amount of vibration of the furnace or the fluttering of the secondary air pressure. Fairly large splashes of slag are thrown out and can easily plug the charging spout, cutting off the tertiary air. Charges with this silica content will not permit the addition of the normal amount of ladle shells, and extra labor is required to crush the shells for feeding to the holding furnaces.

Slags containing 32 to 34% silica are normal. They give a very good coal-used-to-zinc-obtained ratio, and are very easily handled. The furnace does not vibrate much, and very little slag is thrown out the charging spout. All the ladle shells can easily be handled in the fuming charges.

Slags with a silica content below 30% seem to require more coal per pound of zinc fumed. They are usually very fluid, and apparently can run into the tuyere ends because frequent punching is necessary to keep the back pressure down. These charges become very hot and it is difficult to prevent them from running out of the furnace if they find a small hole in the bottom. Such a condition, as a rule, can be stopped by adding cold pot shells or raising the coal, or cutting the coal off entirely for a short period.

Coal Rate Controls Temperature

Slag temperatures are not regularly noted, as no sensing device capable of standing up for more than a few hours has yet been developed. However, on occassions slag temperatures have been taken by sticking a thermocouple into a tuyere. Temperatures noted on graphs were obtained thus.

Temperature at the end of each cycle is about 2,300 to 2,400 deg F. When a fresh slag charge is fed to the furnace, the temperature drops quickly to that of the fresh slag (about 2,150 deg F). Temperature tends to level off or drop a bit more, depending on coal feed and fuming rates. About half way through the cycle, temperature starts a steady rise (about 1.5 deg per min). This temperature rise speeds up to as much as 7 deg a minute during tapping.

Once the slag heats up again, and when most of the zinc has fumed, the amount of coal and air can be reduced. But, the total air flow must be more than 9,500 cfm during the entire cycle, otherwise the zinc recovery will suffer. But if air flow is raised over 10,400, it sometimes exceeds the steam capacity of the waste heat boilers.

Best coal feed rate proved to be 130 to 140 lb per min. Lower rates gave low zinc recoveries and lower fuming rates. Higher feeds than 140 lb per min gave better initial fuming rates, but the total recovery is no better than for 130 to 140 lb. When daily slag tonnage is constant, there is no need to go for high initial fuming rate.

If one furnace should be down for overhaul, the fuming rate can be speeded up by increasing coal feed. In addition, the cycle time can be cut down, with spent-slag zinc-content running a little higher than normal.

Normally with slag of the same composition, the higher the coal rate, the faster the fuming rate. Slags of 34% or more silica use less coal, but tend to be viscous and sometimes foam badly. Plant practice is to sacrifice coal and keep the silica content low to avoid this difficulty.

How Slag Fuming Alters Smelter Routine

Since installing this fuming process, roasting and smelting practices have been altered to accommodate the fuming plant. The smelter treats about 880 tpd copper concentrate, the necessary fluxing silica and about 280 tpd zinc plant residue.

The currently produced zinc plant residue is pumped to the drying plant at about 58% solids. This material is blended with zinc residue reclaimed from a stockpile, which is considerably dryer, in a 7 ft 6 in. by 21-ft tumbling mill to produce a fluid residue slurry containing about 35% moisture. This slurry is carefully metered through calibrated orifices and added to the copper concentrates and silica flux. These three ingredients are then dried to about 10% moisture in a coal-fired 9x80-ft rotary dryer. The careful weighing of each component assures a proper silica content in the subsequently produced slag.

This dried material, which is now fed to the roasters contains much ferrite so roasting time is reduced to prevent driving off too much sulphur.

HBM&S took out of the 7th and 8th hearth on each roaster and uses more coal than ever before. This shoves the roast through the unit faster and provides the necessary calcining temperature without reducing the sulphur content too far.

The reverb is fired by coal, pulverized in Type E-47 Babcock & Wilcox pulverizers. Coal is Crow's Nest, 14,000 Btu and is ground 90% minus 200 mesh. Roasted calcine now has about 8.6% Cu as against 12% before the fuming plant was built. Reverb matte now runs 24 to 25% Cu as against 25 to 26% in the past.

Hudson Bay Mining & Smelting Co., Ltd. smelts about 640,000 tons, gets about 47,000 tons of blister and 34,000 tons of zinc-in-fume a year.

At the present time, a new dust collecting system is being installed to handle all the effluent gases from the smelter. HBM&S will recover the zinc, lead and other metals now going to the atmosphere from the reverb and converter.

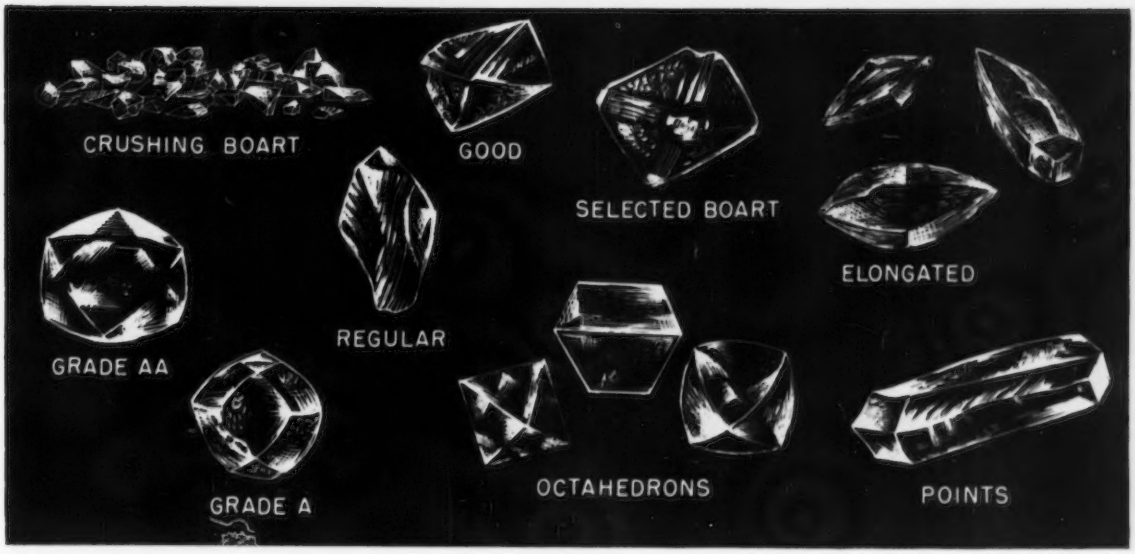
• *E&MJ* wishes to thank the members of the Hudson Bay Mining & Smelting Co. Ltd., staff for their many courtesies extended during our 1956 visit to Flin Flon.

Metallurgy in E&MJ's 1957 Mining Guidebook

CHECK THE COMPANION PIECE to this regular June issue. This bonus reader service contains the following ore dressing and metallurgical coverage: Flotation machine sizes (3 pp), magnetic separation chart (1 p), cyclone variables and controls (6 pp), crusher sizes and capacities (4 pp), filter sizes and capacities (4 pp), dust collecting chart (revised, 4 pp), solvent extraction (2 pp), solids-gas contacting (6 pp), agglomeration (6 pp), and chemical metallurgy (6 pp).

Also included in this valuable addition to any library of modern mining practices are articles on exploration, open-pit and underground mining, maintenance ideas, and power generation and transmission. *E&MJ's 1957 Mining Guidebook* contains 121 pp of vital, up-to-date, useful information, plus the Buyers' Guide and Manufacturers' Directory.

Your 1954, '55, and '56 *E&MJ Mining Guidebooks* are valuable. Hang onto them. *E&MJ* still receives requests for past Guidebooks, which unfortunately are no longer available for distribution. You'll find the Guidebooks a valuable source of information all year around.



How to Get the Most Out of Your Drill Program:

Choose the Right Diamond for the Job

YOU'RE TRAVELLING in expensive company when you join the consumers of diamonds. But your trip can be profitable if you know your diamond bit and the kind of material that makes it work for you.

Diamonds are the hardest substance known; when used as an abrasive, they will wear down any other substance. Diamond drilling is, of course, essentially a grinding operation, so it follows that diamonds are capable of penetrating almost any rock formation encountered.

Relative hardness of a diamond has often been misunderstood because of its rating on Mohs' scale, where quartz is rated at 7, corundum at 9 and diamonds at 10. A better picture can be formed by studying the results of indentation tests reported by the U. S. Bureau of Standards in 1939, where quartz was rated at 710 to 790, corundum 1700 to 2200 and diamonds 8200 to 8500. Instead of quartz being 7/10 as hard as diamond as in Mohs, it is 1/10 as hard by indenter. Chert, the drillers' nightmare, is relatively soft.

Approximately 90% of the world's diamonds are found in Africa, with the Belgian Congo by far the largest producer of industrial diamonds. Other producing areas include the Union of South Africa, Angola, Ghana, Sierra Leone, Tanganyika, Rhodesia, Ubangi and scattered districts throughout West Africa. Lesser sources include Brazil, Venezuela, Borneo and Australia. Industrial diamonds are mined from underground pipes of what is known as blue ground containing diamonds from alluvial deposits; and by power shovel from open pits when the diamonds occur in pockets.

Recovery from ore or gravel is by washing and passing over vibrating grease tables. Diamonds occur in four different forms, which vary in molecular and crystalline structure. These are bortz, Congos, carbonados and ballas. Carbonados are found only in one part of Brazil and are generally known as "black diamonds."

Industrial diamonds are those which are flawed, ill-shaped, discolored or otherwise not suitable for cutting into gem stones (bortz). Of the several kinds of diamond produced, the Congo and West African bortz are now the most common to the mining industry. Diamonds were first used for drilling rock in 1862, and until 1926 only carbonados were hand set in the crowns. The first mechanical setting by molten casting was perfected in 1930, and by 1938 almost all setting of bits was done in this way.

In 1937 the first abrasive-resistant (powdered metal) matrix was developed by Wheel Trueing Tool Co. This is the type in general use today, although technique has been constantly improved as new drilling conditions are encountered.

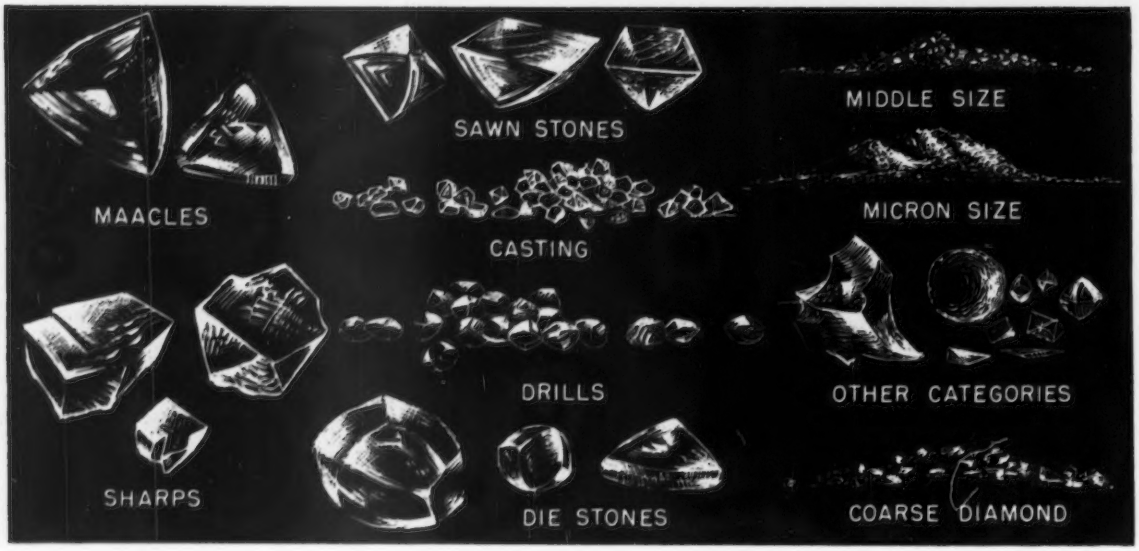
While technical literature does not specifically cover the ratio of hardness and specific gravity between the two types, there is a structural difference between West African bortz and Congo bortz. The former has lines of cleavage which make it subject to a breakage on the cleavage planes. The Congo, which is a conglomerate mass, has not.

Some authorities believe a mixed bortz bit gives the best performance in diamond drilling. The fine crystalline structure of the Congo and the frequent changes of direction of the grain structure will often allow the point of the diamond to crumble, making it subject to apparent wear and at the same time appear to the uninitiated to be softer than the West African bortz. But it will withstand shock better than the West African.

Three Kinds of Bits

Diamond bits are identified according to the diamonds set therein. The two types of diamonds are set in three kinds of bits and, in general, are sold to industry under the trade names of Congo, West African and Bortz, with the first two containing the type diamond which bears that name and the third a good quality mixture of the two. Price per carat of the all-Congo bit is usually cheaper

Material for this article was taken from a booklet prepared by Diamond Tool Research Co., Inc., New York, makers of industrial diamond products, and from a booklet entitled "Do's and Don'ts for Diamond Core Drilling" by the Joy Manufacturing Co.



than the other two, although its quality may cover a wide range. Congo bortz is very effective in the range where larger stones are required for a drill bit and the comparative size in West African would be prohibitive.

The quality, size and shape of the diamonds used in drilling have considerable bearing on bit performance. They always should be placed in the matrix so that their best qualities are employed. Price is not always the best clue to their economic performance. When extremely hard formations are anticipated, bits are often set with a greater diamond concentration. This increases initial cost, but the salvage value after use is usually of higher proportion, resulting in the same net cost. Diamond bit cost is based on carat weight plus a manufacturing cost. The quality of the diamonds set in the bit usually determines the cost per carat.

Buying the Diamonds

Diamonds are sold by carat weight. A carat is 200 milligrams or 1/5 gram. A gram is 5 carats. There are 100 points to the carat (like cents in the dollar) so that a diamond that weighs 0.50 is called ½ carat, or 1.50 carats is called 1½ carats. When requesting parcels of diamonds for inspection and/or purchase, give the following information:

1. How many carats required.
2. Size of stones. State size range required. Small diamonds are designated per carat. Stones weighing 0.02 each are 1/50 per carat. 0.005 each are 1/200 per carat. 0.10 are 1/10 per carat. For sieve sizes and micron sizes see powder list.
3. Quality description.
4. Price per carat.

Loose diamonds for industrial purposes vary widely in price and quality. Lot prices are usually, but not always, lower than selection.

Standard Categories

There are several standard categories of loose industrial diamonds.

Toolstones: diamonds used for dressing and trueing grinding wheels, requiring good cutting points and sound structure to withstand the stresses and temperatures of setting and use. The cost for mounting into a standard type dressing tool is nominal.

Grade AA—Outstanding quality. Four to six excellent natural points with sound inner structure. Ideal for radius, form, thread or gear tooth grinding wheels.

Grade A — Minimum four good points, strong, no cracks. Recommended for straight dressers.

Good—Good quality but lacking in regularity of shape or sharpness of points.

Regular—Regular quality where low first cost, abuse or mishandling are factors.

Selected Boart—Selected boart for lowest initial cost, widely used on coarser grit wheels.

Octahedrons—Many users of toolstones prefer octahedron shaped diamonds. These are eight sided, six pointed stones, like two pyramids base to base. Good octahedrons may have up to six usable points. Many flat sided octahedrons (crystals) have some chisel-edged points which are objectionable for thread grinding or straight dressing but necessary in natural-form dressers. Stones in this shape are commonly available up to ½ carat size. Rounded or transitional octahedrons are bellied out, are a very strong form, and often have sharper points than flat sided octahedrons. The best of these are rare. They are used in tools and offered loose especially as gear grinder dressers. Usual sizes 1/10 to 3/4 carat.

Elongated: elongated shapes at least twice as long as wide, not as sound or well shaped as the points but suitable for form dressing.

Points: long, cigar shaped stones, at least 2½ times as long as wide, of clear, sound material, suitable for coning (60 deg, 75 deg or 90 deg) or for forms. Because natural points are relatively rare in good quality, it is often necessary to cleave rough into this shape. There are therefore two types: natural points and cleaved points.

Maacles: flattish, twinned stones in triangle shape for natural radius dressers, lapped chisels, diaform tools or other sharp angle (40 deg or sharper) tools. Common size ranges 30 per carat to 3/4 carat. The point of the maacle is very hard and well shaped for many purposes.

Sharps: stones that are broken or cleaved so that the edges are sharp. These cutting edges are used for chip-

ping and shaping carbide, green or sintered. The diamond may be held in needle-nose pliers or mounted in a boring bar.

SHARPS A—clear brown cleaved material, very sharp edges with clearance

SHARPS B—sound brown broken material, sharp edges

SHARPS C—broken or cleaved pieces

SHARPS D—cleaved Congo pieces

Some customers may prefer to buy solid Congo round shapes and then cleave them to wanted sharp pieces.

Sawn stones: a whole stone of smooth regular shape, usually Congo, that has been sawn in two. The edges are sharp and have good clearance. For chipping carbide.

Drills and casting: used in surface-set core or plug bits for mining, exploratory, construction work, etc. Available in all sizes, 1/200 per carat up to 1/6 per carat and larger.

DRILLS AAA—sound, whole, roundish stones

DRILLS AA—blocky, fairly sound stones

DRILLS A—off shape, or blocky broken

CASTING—lower grade material

FLATS—too thin or brittle for casting

CONGO ROUNDS—ball shaped, best Congo material

CONGO CUBES—dice shaped, Congo material

CONGO BLOCKY—lower grade, usually with cleaved sides

Diamond Abrasives:

COARSE DIAMOND GRAIN—for impregnated drill bits, concrete, brick and tile saws, impregnated dressers, etc. Crushed diamond in blocky shapes most commonly wanted in 16 to 20, 20 to 30, 30 to 40, 40 to 50, 50 to 60 and 60 to 80 mesh.

MIDDLE SIZE DIAMOND GRAIN—the common grain sizes are 80/100, 100/120, 120/140, 140/170, 170/200, 200/230, 230/270, 270/235 and 325/400 mesh. Used for diamond grinding wheels, dental drills, etc.

MICRON SIZE DIAMOND POWDER—all powder passing through the 400 sieve is called Pan or minus 400. The range of this material is 0 to 85 microns. This is offered in bulk, or very accurately graded to 0 to 1, 0 to 2, 1 to 5, 4 to 8, 6 to 12, 8 to 22, 20 to 40, 30 to 60 and 35 to 85 microns. Size of 35 to 85 microns is the largest sub-sieve size and is often called 500 grit.

Choosing the Right Diamond for the Job

Geological formation	Type of diamond	Diamond size range (per carat)	Type of matrix
1. Very soft			
a. Massive unbroken (chalk)	Semi-round Congo	4 to 8	Standard
b. Broken (fine clay)	Semi-round Congo	4 to 8	Standard
2. Soft			
a. Silt shale	Round Congo	8 to 16	Standard
b. Weathered shale	Round Congo	8 to 16	Standard
3. Medium hard			
a. Sandstone	West African casting	16 to 30	Standard or medium
b. Fractured sandstone	Round Congo	8 to 16	Standard or medium
4. Hard			
a. Hard limestone or dolomite	West African semi-round	30 to 60	Standard or medium
5. Very hard*			
a. Hard igneous rock	West African round	30 to 60, 60 to 110	Standard
b. Fractured igneous	West African round	16 to 30	Hard

*For hematites, jaspers or taconites, use 40 to 80 per carat for uniform solid rock; impregnated bits in factured or broken ground. (Table courtesy Joy Manufacturing Co.)

Drilling Recommendations*

Type of bit	Rock conditions	Pressure and rotational speed
Bortz bit with relatively few large stones	(a) Soft to medium hard rock, medium to coarse grained.	Moderately heavy pressure and medium rotational speed
	(b) Rock with soft particles mixed with hard coarse-grained particles	Heavy pressure and somewhat higher speed
	(c) Hard rock and deep drilling	Increased speed and heavy pressure. Heavy drill required
Bortz bit with large stones. Large clearance on bit and reamer. AX size bit	Fibrous rock (asbestos)	Medium pressure and speed. Very high water pressure and volume
Bortz bit with large number of small stones	Hard, solid ground	Lighter unit pressure than for a bit with larger stones. To avoid polishing, increase the pressure with speed.
Similar bit with dull stones		Increase pressure over that for sharp stones
Impregnated bit	Hard, fine-grained rocks	Light pressure, never sufficient to slow down the drill. Speeds of 1,500 rpm or over for an EX bit. Slower speeds as bit size increases

*Diamond Drill Handbook, J. D. Cumming.

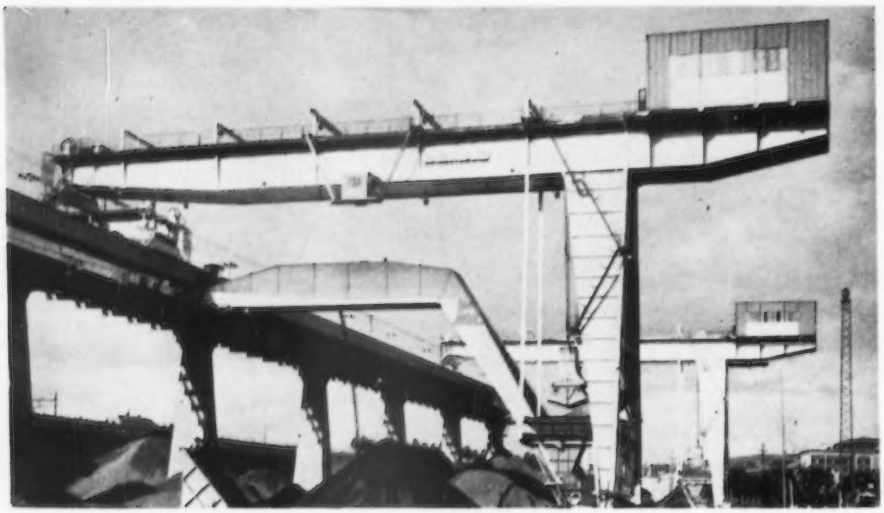
Die Stones: sound clear stones of, or close to, gem quality. After being flatted, drilled, polished and cased these become wire-drawing dies. The wire is drawn through a polished hole in the stone, and takes its brightness and accurate size from the diamond. Size 10 per carat to 1 carat and larger. The best and most expensive die stones suitable for most recuttings (to larger sizes, after wear) are clear global shapes. Any clear stone can be used.

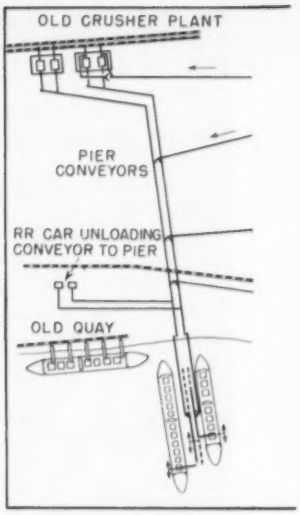
Crushing Boart:

CONGO CRUSHING BOART—crushed in a mortar and separated into grits and powders, used in wheels and sold as abrasives.

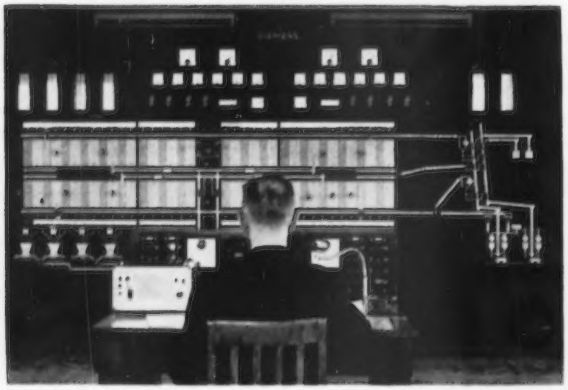
WEST AFRICAN CRUSHING BOART—costs more than Congo and is more crystalline in appearance. Preferred sometimes by diamond die makers, and for specialized uses.

Other categories: diamonds, not described above are carbonados (black diamonds), ballas (expensive ball shapes, grain radiating from center), glass cutting stones (vitriers), flats (for bruting or shaping diamonds), reclaimed diamonds from drill or tool scrap, indenter diamonds, etc.



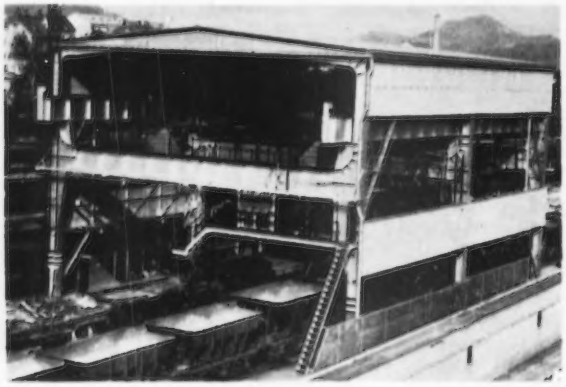


Narvik Conveyors



From a Single Control . . . . .

THE OPERATOR maneuvers ore from the crusher to the elevated conveyor line to the conveyor bridges which will place it in the proper stockpile. Grab bridges pick up and conveyors reverse direction at his order. Siemens panel also features warning system and instant alarm signals.

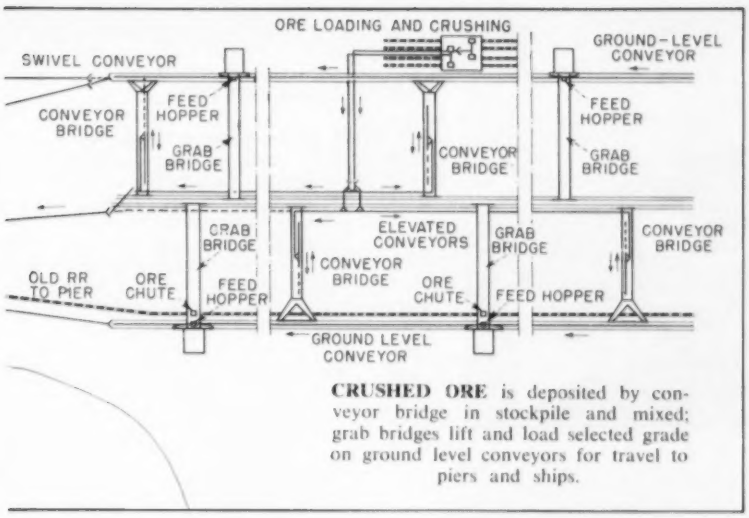


Narvik Unloads the Ore . . .

BOTTOM DUMP CARS deposit the ore into a system of bunkers and crushers (cone, 1,000 tph) which take it down from 10-in. lump size to 4-in. More than 9-million tons are handled annually, with car shakers, flame throwers and jack-hammers providing an assist when the ore freezes.

And Mixes it by Grade . . .

THROUGH THE BOTTOM of the conveyor bridge the ore is spread evenly across its stockpile. Ten grades are handled and kept separate at Narvik with the help of the conveyor bridge's inclined belt and the travelling belt below. Both belts are reversible and fast-moving.

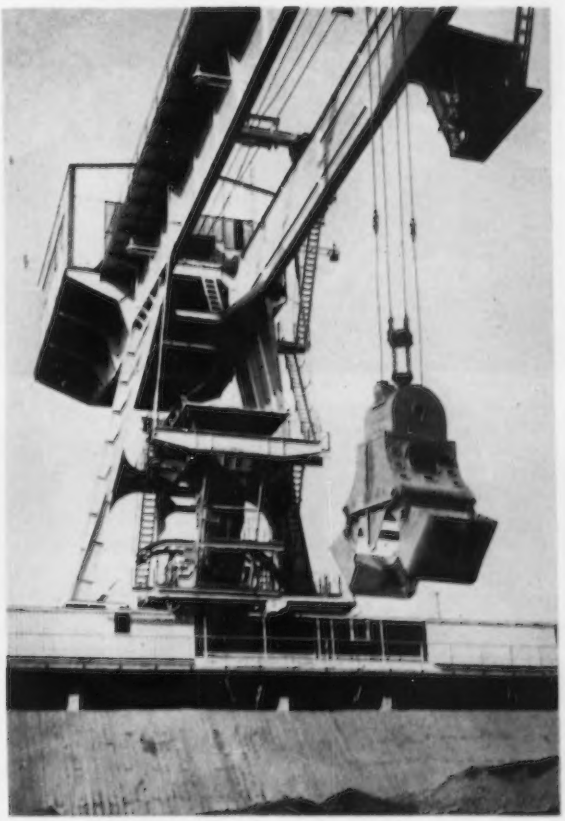


CRUSHED ORE is deposited by conveyor bridge in stockpile and mixed; grab bridges lift and load selected grade on ground level conveyors for travel to piers and ships.

Sort, Mix and Load Sweden's Ores

LAPLAND IRON ORES account for the major share of Swedish ore production; approximately 70% in 1953. The most important deposits are at Kiruna and Malmberget, where 9.5-million metric tons and 3-million tons, respectively, were mined in 1953. Seventy-five per cent of Lapland's ores are hauled to the ice-free port of Narvik for shipment.

Annual shipment of more than 9-million tons demanded expansion of the port's loading facilities. By 1956, DEMAG, the West German firm, had finished the expansion and turned over to the Swedish LKAB Co. the largest port installation in Europe: a 2600x330-ft stockyard, with facilities for mixing and separating ten different grades of ore and for loading individual grades directly on ships whenever needed. Story and photographs are the work of Engineer Karl Schmoll, of Duisburg, Germany.

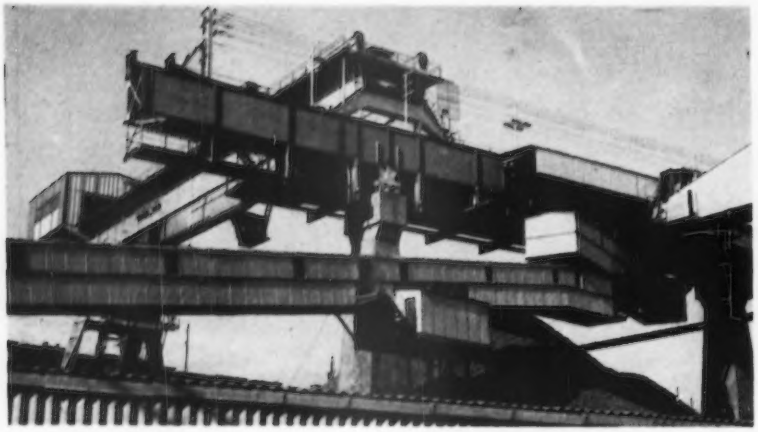


In Separate Stockpiles . . . . .

CONVEYOR BRIDGE cannot only mix by moving the conveyors perpendicular to the main conveyor system, but also by shifting the entire bridge parallel to the main conveyor system. Placing of separate shipments in layers is a further guarantee of consistent mixture.

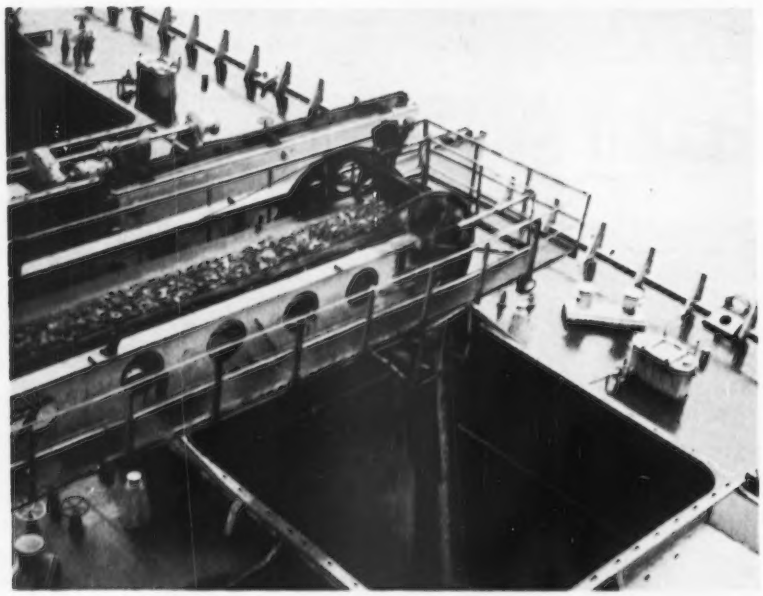
For Pick-Up by Grab Bridge.

ONE OF FOUR 1,000-ton per hour grab bridges lifts ore into its own hopper for transfer to the ground-level conveyor trip to the loading pier. The 18-ton grab moves the length of the 170-ft span, mixing the ore again as it bites through several deposited layers of mineral.



Main Conveyors . . .

THE CORE of the system is the pair of reversible belt conveyors which supply the conveyor bridges. Each belt is 1,350 ft long, and rides on the center structure which provides the crane runway for four conveyor bridges and four grab bridges. With the new system in operation, Narvik can unload 4,000 tph and load an equal tonnage on ships without delaying either operation. Total length of all belts is 4 miles.



May By-Pass Bins . .

SEPARATE CONVEYOR SYSTEM is capable of switching ore (particularly that from Kiruna) direct from the main elevated conveyor line to the pier conveyor, as seen in photo above. Pier conveyors feed retractable cantilevers with belt conveyors for discharge directly into the ships' holds. Operation is year-round, necessitating enclosure of all conveyor belt lines and idlers. Old railroad line also serves incoming ships.

To Load the Ships.

PICTURE-BOOK HARBOR at Narvik is one of the most important in northern Europe. DEMAG-installed loading system now permits simultaneous loading of two ships with different grades of iron ore. Besides the obvious advantages in selectivity of ore and proper storage facility, the new network takes type and grade of ore as it comes into storage and is still able to supply a ship's cargo without expensive demurrage.

PRESENT known reserves in the Bathurst-Newcastle area are 128-million tons to vertical depth of 1,000 ft, except for Texas Gulf orebody (2,200 ft here).

New Brunswick Develops A Major Mining Camp

C. P. JENNEY

AS OF DECEMBER 1956 there were 51,574 mining claims in good standing in New Brunswick, against 314 claims in 1932. As an indication of the money being spent on exploration alone — without considering mines under development and being readied for production—it is estimated that there were 50 diamond drills operating in New Brunswick last summer and 20 were said to be running during the past winter.

This means that the summer drilling bill was about $300,000 a month and the winter bill was about $120,000. Combining this information with other related exploration costs, I estimate that $12-million was spent on exploration in New Brunswick during 1956.

As shown on the map, the roughly elliptical area of interest is approximately 40 miles north-south by 30 miles east-west. Within this area, rocks are Ordovician and Devonian in age, and the main structure of interest is the domal area in the center. Younger rocks bound this area on the north, east and west.

Major domal structure is outlined in general by the distribution of the quartz-feldspar porphyry. This is a Mount Pelee or glowing avalanche type of volcanic eruptive similiar to that so aptly described by Thomson and Williams in connection with their work in the Sudbury area. In the field, rock has been variously named porphyry, crystal tuff, tuff and agglomerate, sheared ash beds and sheared sediments—it is all of these! Frequently light colored and almost white weathering, it occurs as a porphyry with or without rounded quartz eyes and/or medium to large phenocrysts of angular feldspar and includes masses of sediments and fragmental material. Shearing and platy structure are common and many bands of argillaceous and graphitic sedimentary material are found within it.

Ore Occurs in Green Schist

Associated with the porphyry and often adjacent to it, is a tuffaceous or sedimentary member of the same series which is now a light to dark green chloritic schist. This rock is usually laced with narrow quartz stringers folded in all attitudes and ramifying in all directions. Except for two occurrences, all the important ore found to date in New Brunswick—either occurs in this green schist or adjacent to it within the porphyry itself.

Two other volcanic rock types have been mapped in the area and are closely related. One is a series of acid to intermediate rocks that are typically fine-grained, dense, light colored rhyolites, but include large areas described as quartzite, as well as masses of typical porphyry and greenstone. Second volcanic type is a more basic greenstone with some acid members and some intermixed sediments.

To date we know little of this whole volcanic series, except in general distribution and the remarkable occurrence of replacement sulphide ore within one or more of its members. We know that these rocks are noteworthy for their variation and that, frequently, it is impossible to correlate between closely spaced drill holes. Although the series as a whole is easy to recognize, the detailed stratigraphic sequence will be difficult or impossible to determine.

Other rocks in the area are granites, granite gneisses, diorites, gabbros, graywackes, arkoses and other sediments. They require no specific comment, except to note that small masses of gabbro, frequently carrying minor scattered pyrite-pyrrhotite mineralization have been found in the vicinity of all large orebodies discovered to date.

Many orebodies show tight drag folding with selective replacement along bands of these drag folds. Mineralization at Anaconda's Caribou occurs on the limbs of a steeply plunging syncline of major dimensions, and indications of a major folding have been found at Heath Steele, Brunswick and many other properties.

Orebodies of the district are massive sulphide replacements of two gen-

Mr. Jenney is consulting geologist, Toronto, Ontario. This paper represents the highlights of Mr. Jenney's talk before the New York AIME section, April 1957.

eral types—an extremely fine-grained pyrite with sphalerite, galena, minor chalcopyrite and appreciable silver; and a pyrrhotite-chalcopyrite with minor zinc, lead, silver and some gold. The two ore types are sometimes intimately mixed and may have to be mined together.

Metallurgy Will Be Complex

Metallurgy is a serious problem, and has retarded exploitation of the two large sulphide masses owned by Brunswick Mining & Smelting Corp. These difficulties are due to the very fine intergrowth of copper, lead, zinc and iron minerals which are sub-micron in size, but also to presence of certain oxidation products. Three treatment processes are being currently studied.

In addition to the ore types mentioned, many of the numerous graphitic zones of the district carry appreciable amounts of primary marcasite and pyrite with very minor sphalerite, galena and chalcopyrite. In a number of cases, one or two drill holes have shown impressive widths of this material with ore grades, while subsequent drilling failed to find continuity.

Weathering and oxidation have produced striking gossan zones over some of the sulphide orebodies. Complete oxidation to depths of 150 ft have been reported, and depths of 30 to 40 ft are common. However, many massive sulphide zones have little or no gossan while nearby masses are deeply oxidized. Secondary enrichment of the near-surface portion of Heath Steele "B" orebody has produced an upper layer of gold values of approximately 0.2 oz overlying a copper zone averaging 3 to 4% Cu. In some cases presence of gossan or pieces of gossan float led to the discovery of the underlying sulphide mass.

Exploration techniques include airborne electromagnetic and magnetic surveys, ground magnetic, electromagnetic, self-potential and gravity surveys, detailed geologic mapping, tracing of float, geochemical surveys and water sampling, and pure geologic deduction and extrapolation based on any and all combinations of these methods.

Of the mines and prospects shown on the map, it is safe to say that ground electromagnetic work was the principal discovery tool in at least three cases, and that airborne electromagnetic and magnetic survey resulted in the discovery of at least five more. Two were reportedly found by tracing mineralized float back to its source and pin-pointing the source with ground geophysical surveys. Broad geologic deductions followed by detailed geologic mapping led to at least three discoveries.

At least two companies used stream testing, with both water and stream sediment sampling, as a broad reconnaissance tool. Since so many of the streams and springs in New Brunswick give anomalously high results, these methods have led to a large number of mineralized areas, but to date cannot be credited with a discovery of importance. The same may be said of widespread soil sampling, which has been tried.

Companies in the Area

It should be clearly understood that the following comments are my own and none are official announcements by any company.

Austin Brook, Anacon-Leadridge and New Larder U need no comment since the facts have been published in annual reports.

—Billiton property is significant mainly since it signals the first activity of these Dutch interests in Canada. Underground development is in progress.

Tetagouche Exploration property and the two new Anaconda discoveries are in the drilling stage.

Anaconda's Caribou has responded favorably to drilling. This sulphide body is remarkable for its continuity, both longitudinally and depth-wise, and the controlling synclinal structure itself which plunges steeply northeast, is a prominent feature of the regional geology. Replacement is in green schist beds below typical porphyry and above a graywacke-slate series.

Kennecott's discovery is remarkable for its size. The gossan zone is reported to be in the order of 3,000 ft long and 150 ft deep. Very little is known as only a few drill holes are down. This gossan zone was apparently untouched by glaciation and no airborne electromagnetic response was obtained over it. Primary material is fine-grained massive pyrite with some lead-zinc mineralization. Chalcopyrite is also reported. Thicknesses of up to 300 ft have been indicated by drilling.

American Metal Co.'s Elbow Property is typical of certain mineralization in the area. Ore intersections obtained to date are chalcopyrite in pyrrhotite with negligible lead-zinc. Mineralization is a replacement in green schist adjacent to porphyry. Geology and mineralization are extremely erratic, and to date no clear picture of the mineralized area has evolved.

American Metal's California Lake and Kennecott's Nepisiquit are also typical of certain New Brunswick deposits. In each case, one or two drill holes in a graphitic conductor zone gave impressive ore-type intersections (10% Pb over a core length of 45 ft) but subsequent close drilling failed to intersect ore.

Heath Steele Mines property includes a number of orebodies of both the types mentioned previously and with some intermingling of these two types. The drill indicated ore reserves, as of Dec. 31, 1956, to a depth of 300 ft, have been published and since that time no drilling has been reported. Two open pits have been developed and underground work is in progress from two shafts, two miles apart. Production started early in 1957, and full production is expected by mid-year. A large part of the property remains to be explored.

Stratmat discovery is a differentiated copper-lead-zinc orebody in an northeast striking shear. It occurs in intermediate volcanics and is not associated with green schist-porphyry series. Control seems to be a non-mineralized gabbroic diabase and the metallics are pyrite, chalcopyrite, sphalerite and galena. Although not one of the major deposits of the area, according to present indications, it is an interesting deviation from type. Dip of the deposit varies from 40 deg SE at the west end (where the diabase forms the hanging and footwall) to 80 deg SE at the east end (where the volcanics form both walls).

Captain Yellowknife discovery is also in a shear zone of limited proved length but with much greater dip extent. It is located on a porphyry-sediment contact and is a low-grade copper occurrence.

Texas Gulf Sulphur-Conwest orebody is remarkable for its dip continuity. It is thought to be a series of overlapping lenses with the main zone having a strike length of only 450 ft, and a width varying between 40 and 60 ft. Zone has been indicated by detailed drilling to a depth of about 2200 ft on the 38 deg dip. At a depth of about 3500 ft on the dip, 85 ft of core averaged 3% Pb and 7% Zn.

Kennecott's Clearwater is another variant from the type orebody of this area. It was located by an airborne electromagnetic survey and was one of two good responses selected. In drilling one of these anomalies, a zone of massive pyrite ore containing lead and zinc was found. Pattern drilling of the lead-zinc zone indicated a separate flat shoot of copper mineralization in chloritic schists. Neither of these zones is associated with a typical porphyry.

Minnesota Symposium Charts Progress in Rock Breaking

DRILLING AND BLASTING was the topic of a symposium held under the auspices of University of Minnesota's School of Mines and Metallurgy and Center for Continuation Study in Minneapolis Oct. 11 through 13, 1956. This sixth annual event brought together men dealing with applied research and development as well as those concerned with fundamental research. While the following briefly summarizes all papers presented, there are many important details which can only be gotten in the complete proceedings which are available from the University of Minnesota, Institute of Technology, Minneapolis 14, Minn.

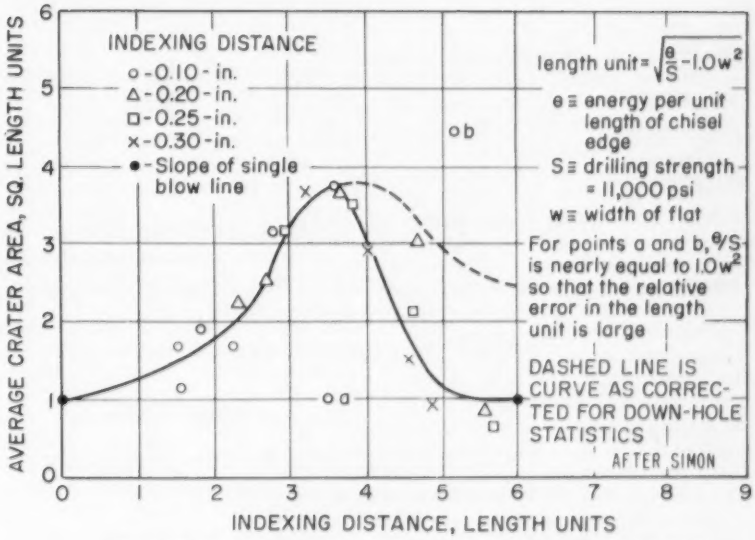
Rotary Drilling of Blast Holes on the Mesabi Range (5 pages) — R. E. Thompson, M. A. Hanna Co.

Although most of company's blast hole drilling on central Mesabi Range is still with churn drills many advantages of rotary definitely show it has its place.

Churn drills are better adapted for drilling in small rough areas and for pre-drilling exploration holes with casing. A small operation could not stand initial cost of rotary.

Rotary Bits in Taconite and Other Hard Rocks (8 pages)—George W. Baur.

Round button inserts of sintered tungsten carbide, rather than teeth, increased roller cone bit life about 5 times and, occasionally as high as 15 times, giving considerable saving in bit changing costs. Cones themselves have heavier nose—a radical departure from modern oil field design. Inserts are also added on base of cones and on bit body. Best grade of hard metal to use has been determined through tests. Present sizes are 9, 9⅞, 10⅝ and 12¼-in. Experimental sizes are 6¼ and 6¾-in.


AVERAGE CRATER AREA, SQ. LENGTH UNITS
INDEXING DISTANCE
o-0.10-in.
Δ-0.20-in.
□-0.25-in.
x-0.30-in.
•-Slope of single blow line
length unit = √(e/S - 1.0w²)
e ≡ energy per unit length of chisel edge
S ≡ drilling strength = 11,000 psi
w ≡ width of flat
For points a and b, e/S is nearly equal to 1.0w² so that the relative error in the length unit is large
DASHED LINE IS CURVE AS CORRECTED FOR DOWN-HOLE STATISTICS
AFTER SIMON
a
b
INDEXING DISTANCE, LENGTH UNITS
UNIVERSAL INDEXING CURVE FOR 0.03-IN WIDE DIE

CURVE shows there is an optimum indexing distance for producing largest chip.

Comparison of performance in taconite and other iron formations must include careful consideration of the highly variable nature of formations.

Churn Drilling in Taconite at the Pilotac Mine (9 pages)—Peter DelGreco, Oliver Iron Mining Div., U.S. Steel Corp.

Over 25% of taconite mining cost is drilling. Pilotac is only large scale taconite operation using churn drills —B-E 42T's and 50T's. Systematic approach in studying every variable is essential.

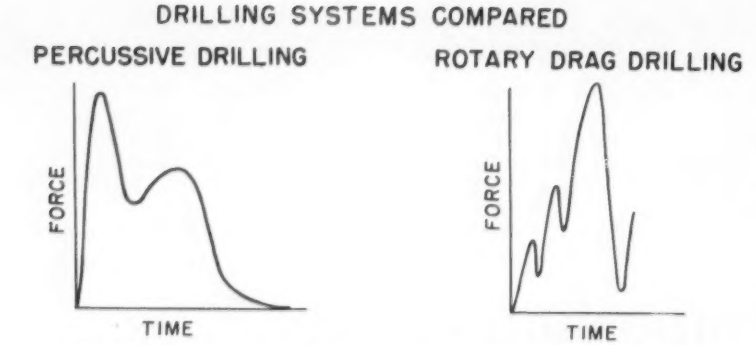
In 1952 one 9-in.x20-ft hole took two 8-hr shifts with 7 bit changes. Now four holes are drilled under same conditions.

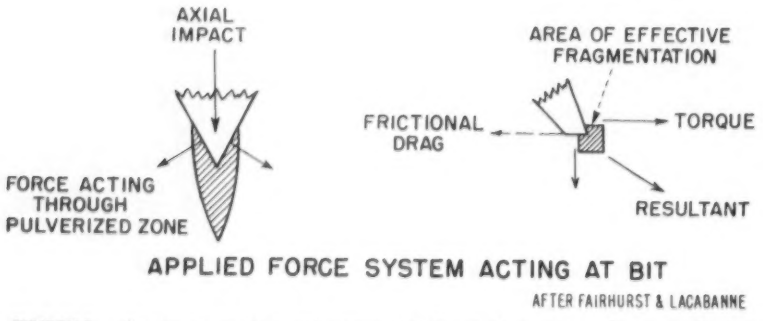
Bit design changed clearance angle from 15 deg to 5 deg to give better support to cutting edge. Tempering hardness is closely controlled with Brinell tests. Tool weight was increased by adding 5 ft to standard 30 ft stem.

Best stroke was 40 in., giving penetration rate of 4.98 ft per hr and bit life of 11.5 ft. Synchronization of stroke was best at 52 per min. Hydraulic tool guide permits faster "spudding-in."

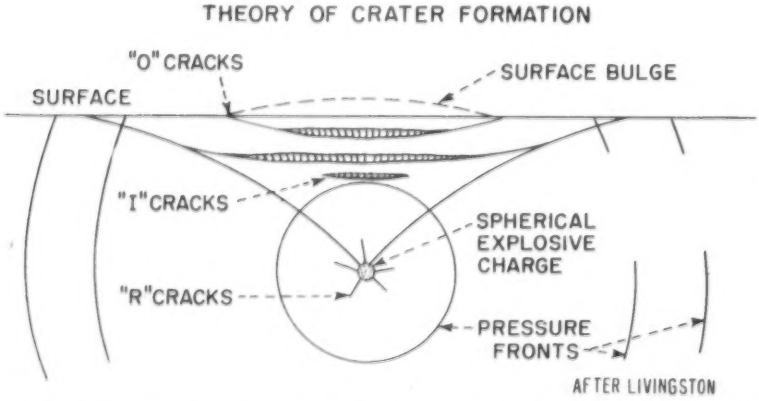
Bit change is determined by careful watch for bounce of dull bit, giving more hole per hour. By carefully tracking new bit in pattern of old bit and by reducing speed and using tightline to square bottom of hole, chipped corners are reduced, giving better bit performance and less tramp iron grinding.

Operator and supervisor performance are improved through education and detailed record keeping. Im-





FORCES acting in percussion and rotary drilling result in same effect—production of chip by fracture to free surface.



FRAGMENTATION of rock in blasting results from several effects. Surface bulge is caused by reflection of shock wave.

proved preventive maintenance and other supporting operations gave added savings.

Results, since October 1952, include a boost in bit change footage from 3 to 10 ft and drill rate upped from 10 to 30 ft per shift. This places churn drilling in direct economic competition with other taconite drills.

Drilling and Blasting Practice at the Iron and Titanium Ore Operations in Upper New York State (6 pages)—Fred West.

At Benson Mines, comparative figures for 50-ft high cut are:

B-E42T churn—9¼-in. hole on 20x24-ft (burdenxspacing) pattern (bottomed 6 ft below grade)—33 ft or 1,285 tons drilled per shift; bit life, 10½ ft per sharpening; 2.4 tons per lb of powder.

Joy Challenger percussion—4-in. on 13x15-ft; 170 ft or 2,720 tons; "X" bit life, 570 ft; 3.5 tons.

G-D DH143 percussion on Airtrac—5-in. on 16x18-ft; 170 ft or 4,210 tons; cross bit life, 350 ft; 3.5 tons.

Joy 60BH rotary—9⅞-in. on 24x-30-ft; 115 ft or 6,485 tons; steel roller cone bit life, 600 ft; 2.4 tons.

*I-R Drillmaster down-hole percussion—6½-in. on 20x20-ft; 90 ft or 2,925 tons; cross bit life, 1,600 ft.

* Estimated from results at National Lead's pit at Tahawus where ore is similar.

Thus churn drills are shown to be out-performed but rotary is probably not of much use on poor breaking ore or on rough terrain. The smaller percussion drills seem especially suited for blocky ore.

Drilling and Blasting Developments at Reserve Mining Co. (7 pages)—Floyd W. Erickson.

Linde jet piercers open a 6½-in. minimum dia hole to depths of 50 ft at up to 35 ft per hr in hard taconite. Chambering is easily done by repeating pass.

At present, production "box" cuts are turned off from an initial east-west development cut at right angles on 1200 ft centers. North-south mining faces advance east and west. Holes average 8 in. dia and are drilled in straight lines on 22-ft spacing about 35 ft deep with 5 ft below grade. Two passes are used to chamber bottom 5 ft to 13 in. dia. From 10 to 20 rows are blasted, first row burden is 20 ft and others 16 ft. Powder factor is 0.52 lb per ton. About 250,000 tons are broken per blast.

Tractair percussion units have replaced the earlier used hand piercers for "satellite" holes used to break blocks formed by surface joints. Holes are 1½-in. dia x 3 to 5-ft deep in visible blocks or at 6-ft centers surrounding main hole with which they are blasted. Single deck charge 2-ft below collar, and sometimes a second one at 6 ft, have also proved effective. Both cause some fly rock.

Tractair units are also used for secondary block holing, replacing mudcapping which earlier had replaced drop-ball.

Cleveland-Cliffs Iron Company's Mesaba Range Drilling and Blasting Practices (3 pages)—John R. Knudson.

Although completely lacking water resistance, prilled ammonium nitrate fertilizer for farm use, to which is added one gallon of fuel oil per 80-lb sack, has shown no limitations in soft and hard ores. But it has not been tested in solid rock.

Nine-inch rotary roller cone drilling costs are considerably less than 6 and 9-in. churn drilling costs. Bit life was increased sizably by lowering bit pressure from 600-800 psi to 400 psi with no reduction in penetration

rate. Both a steel bit—used in soft wash ores—and a WC inserted bit—used in harder formations—which were badly gage-worn were built up with Stoodite welding rod at a saving.

Blasting with Low Cost Explosives on the Mesabi Range (2 pages)—Richard E. Thompson, M. A. Hanna Co.

In last two months of 1954, blasting agent consisting of 95% ammonium nitrate and 5% carbonaceous material packed in 50 lb plastic bags ($10.50 per 100 lb) replaced 75% of standard semi-gelatin ($17 per 100 lb) pound for pound. Remaining 25% was standard—required below water line and to supply good primer. Cost saving was 26%.

In 1955 use increased with improved water resistant type for 80% replacement at 27½% saving. Semi-gelatin was used only for primers or in hard taconite.

In 1956 (through September), 83% replacement gave 34% saving using E.P.197 and E.L.490 at $9 per 100 lb and water resistant E.P.194 and nitramite at $11.50 per 100 lb.

Latest work is with fertilizer grade ammonium nitrate costing $5 per 100 lb to which is added fuel oil to give over-all price of $5.25 per 100 lb. Savings should increase to 50% of old method of using all semi-gelatin explosives.

New Concepts in Drilling & Boring Rock (13 pages)—James S. Robbins, Consulting Engineer.

A "bored" tunnel has many advantages. Machines can now be made to drive circular cross-section of almost any size at speeds and costs competitive with drilling and blasting. One example in shale is water diversion tunnel of 26 ft 9 in. dia driven 635 ft in a 6-day week. Sewer tunnel in sediments, including sandstone, at Pittsburgh gave about same speed using about three times thrust. Water tunnel in limestone at Chicago is planned.

Principle of boring used in machine is to cut concentric grooves (kerfs) with continuously scraping prongs and to break down resulting lands with efficient wheel-like rolling discs. Conveyor moves broken rock to rear. Pressure is less than 5% of pressure per unit area used in rotary drilling. Principle could apply to blast holes and other drilling.

Theory of Rock Drilling (34 pages)—R. Simon, Battelle Memorial Institute.

Experiments, under auspices of Drilling Research Inc. (an organization sponsored by oil production companies) considered elementary action of impact of chisel edge on rock. This action is common to drilling by percussion and vibration with roller cone bit, cable tool and pneumatic hammer bit.

Rate of penetration is:

$$R = \frac{A\ f_v\ N}{\pi\ D}$$

A=area (on cylindrical surface at hole periphery) cut by single impact of single chisel edge.

f_v=number of blows per unit time per wing or roller

N=number of wings or rollers.

D=diameter of bit

To determine A, experiments involved Indiana limestone sample, a simple guillotine-like "drop-tester", chisels of various shapes and sizes and weights. Cleaned out craters were filled with Plasticine and casting weighed to get average crater cross-sectional area.

Results show area depends primarily on: (1) energy per unit length of chisel edge, e; and (2) distance between successive impacts, called indexing distance, I. In a sample of any given rock, for a given cutting edge flat or width, w, there is a mathematical relationship between A, I and e. Using a quantity called Length Unit, "L", which relates factors to each other, values plot a bell-shaped "Universal Indexing Curve" which type of curve is applicable to all rock. From curve, an optimum relationship is apparent.

Tests indicate that the law of geometrical or dimensional similarity applies to rock and implies that rock can be considered homogenous when average of a number of impacts are considered. Experiments also indicate that considering new surface area produced (as in comminution theories) energy for drilling is small compared to energy required to stress rock to failure.

It also becomes apparent that a single constant — the Drilling Strength, "S", which is energy (in.-lb.) per unit length (in.) of chisel edge divided by average cross-sectional area (in.^{2}) of crater produced by wedge of specified included angle (in this case, 90 deg)—is probably sufficient to specify drillability of brittle rock. But if rock acts plastically (as all do with increasing confining pressure) it becomes more complicated.

Final result of corrections to universal curve to accommodate drill hole conditions in brittle rock, is that if "I" exceeds about twice optimum, then at the periphery

$$A = 3.7\ \left(\frac{2E}{NDS} - W^2\right)$$, where E is total energy per impact.

Based on further assumptions and theories, an optimum relationship is deduced with which drilling rates can be compared:

$R = 2\ P/D^2S$, where P is power input.

Thus for Columbus limestone (S= 40,000 psi) and a 10-in. dia drill hole, application of 100 hp should give a rate of 100 ft per hr.

If more experiments had been done, the numerical coefficient (i.e. "2") of P/D^2S, would probably have been found to be a function of w/I with some optimum maximum.

Since the experiments were done with a flat termination of cutting edge and in practice a bit wears to a round edge, there is probably an optimum ratio of that radius to I also.

Some Principles and Developments in Hard Rock Drilling Techniques (26 pages)—C. Fairhurst and W. D. Lacabanne, Div. of Mineral Engineering, Univ. of Minn.

Stress transmitted to rock by conventional drills is essentially compressive and acts normal (i.e. 90 deg) to bit faces. Compressive stress component toward free rock surface causes free chips to form and is more efficient than crushing effect.

In percussive drilling, an axial impulsive blow causes a symmetrical wedge to penetrate rock by crushing and fracturing. Since during penetration bit load is essentially axial and since bit rotates to new site while free of rock during rebound after each blow, abrasive resistant carbides can be used with little disadvantage from tensile weakness. Acute wedge angle gives deeper penetration per blow and hence faster penetration but abrades faster than obtuse angle. Method is considered inefficient because: (1) percussive rock drill blows occur only every 33 ms while actual penetration takes only 1 to 3 ms; and (2) considerable crushing takes place which consumes more energy per unit volume than does chipping.

In rotary drilling, stress (torque) acts in direction more conducive to chip forming (i.e. toward surface) and crushing is slight. Although force is applied continuously, fracturing is intermittent (about 1000 to 2000 per min) giving rise to bending impact loads on bit tip which is disadvantageous for carbide inserts. Thrust, which is essential for keeping bit against face, causes high abrasive wear on under (or trailing) face and high frictional drag.

In combination or rotary-percussive drilling, mechanism of penetration is still being investigated. The axial impulsive blow which is added to ro-

tary action, crushes and fractures rock underneath tip. This weakens rock and thus reduces frictional drag and lowers thrust requirement. Some of blow also aids torque effect. Bit is of stronger design than rotary bit and impulsive blow tends to counter bending (tensile) stress of rotary bit. Thrust must prevent rebound but not stall machine.

Comparison of systems is as follows:

Percussive drilling

1. Can be used in most rocks.
2. Does not require heavy thrusts and machines can be either hand-held or lightly supported.
3. Bit is mechanically robust.
4. Has limited penetration rate.
5. Is an inefficient method of breaking rock.
6. Normally uses the inefficient compressed air powered machine.

Rotary Drilling

1. Is limited to use in soft or medium hard rocks that are not very abrasive.
2. Requires heavy thrusts, usually supplied by well supported drill rigs.
3. The drill bit is inherently weaker than the percussive design.
4. Is capable of high penetration rates in suitable rocks, the cutting process being more continuous than by percussion.
5. Is more efficient than percussion, generally producing much larger rock chips.
6. Can readily be used with electric power, again improving the overall efficiency.

Rotary-percussive drilling

1. Can be used on most, including very hard rocks.
2. Requires fairly well supported rig.
3. Bit is compromise between rotary and percussive.
4. Has high penetration rates in very hard rocks but requires blows of higher energy and frequency than straight percussive.
5. Considered solely on power consumption, efficiency is less than rotary but more than percussive.
6. Current German models are air operated.

Russians claim that adding percussive impact on roller cone bits in hard limestone increased penetration rate 15 times.

Ingersoll-Rand's down-the-hole percussive Drillmaster (Depthmaster) has independent out-of-hole rotation. Torque can break down sides of imprint but bit rebounds so system is not truly rotary-percussive.

R-P drilling shows promise for much higher penetration rate in rocks previously too hard to drill by anything but diamond or straight percussive drilling methods.

Theory and New Developments in Explosive for Blasting (26 pages)—Melvyn A. Cook, Explosives Research Group, Univ. of Utah.

Available energy (which is shown to be closely equal to total heat of explosive) and peak borehole pressure (which is shown to be directly related to detonation velocity) are actually the only factors needed to precisely select the best explosive for a particular application and to give the proper borehole size and spacing. [Apparently, although the presently used factors of density, energy per unit weight (per cent strength) and detonation velocity are related to the above, they require an empirical or experience factor in applying them, whereas equations herein offered do not use such a factor—Ed.]

Although available energy must be enough to move burden, borehole pressure—or more precisely, the pressure-time curve—is more critical factor in determining blasting action of an explosive. It depends on loading density (tamping) as well as explosive's characteristics [and confinement (stemming)-Ed.]. It can be accurately computed.

In mudcapping, the more mud the better. Also the explosive should be placed to give maximum area of contact with rock using a minimum of mud between powder and rock to make contact continuous. Placement should consider directional effect of explosive. Most economical explosive is 40% straight gelatin.

Although nitroglycerine base explosives currently far outweigh other types in versatility for commercial blasting, ammonium nitrate explosives have proved advantageous for larger diameter surface blasting and they hold promise for small diameter holes underground as well. They are most economical and least hazardous.

Theory of Fragmentation in Blasting (16 pages)—Clifton W. Livingston, Barodynamics Inc.

Considering crater blasts for rocks in which elastic behavior predominates over plastic behavoir, propagation of stress caused by explosion exceeds rock movement and produces a shock wave. Shock wave reflects from free surface inducing a tensile stress which causes "o" (circular) cracks or slabs to form from surface back toward drillhole. At same time, radial "R" cracks, which proceed out from periphery of drillhole, are formed by action of expanding gas bubble and result from failure in tension. A third, "I" (inward), series of cracks form at right angles to "R" because of differential uplift of surface as gas-bubble expands.

The proportions of energy transmitted to atmosphere and to rock plus the manner in which rock portion breaks the rock, establish 4 ranges of failure. [As stated at Colorado Symposium, first range is called Strain-Energy and covers conditions up to point where surface cracks begin to form. Shock Range embraces conditions from that point up to development of full crater. In Fragmentation Range changes occur in shape of crater, degree of fragmentation and production of flyrock. In Air Blast range energy transmitted to air exceeds that transmitted to rock. — Ed.] Range limits are best described by a "depth ratio" of charge depth divided by critical depth. Which gives rise to several useful formulae.

The Shock and the Fragmentation ranges are important to the blaster. Volume of rock broken per pound of explosive reaches maximum in Fragmentation range. Characteristic curves (and formulae) for explosives, just as for pumps, can be developed to help in selection for desired results in a given rock.

Use of Seismic Methods to Improve Blasting Practice (16 pages)—L. Don Leet

Seismic investigations can improve blasting practice as well as investigate complaints. A relatively rugged and simply operated seismograph is available which can measure the required three components of earth motion.

Mere reduction in quantity of explosive does not necessarily mean reduction of vibration. Many variables of geology and blasting scheme must be examined.

At least three or four of the six known types of seismic waves are generated in a blast. Each travels with a different speed in any given material and each weakens differently. Usually one dominates but the superimposition of others can multiply amplitude several times, especially close to source where peaks are close together. This makes frequency as well as amplitude important in analysis.

Short period delays effectively spread out maxima and hence reduce resultant amplitude of vibrations. Experience indicates that to do this a delay of about 0.001 sec per ft of spacing is good in quarry well-drill blast holes. Longer delays increase danger of cutoffs. Fragmentation is also better. But more study of basic mechanics is needed.

How to Reduce Gold Losses In Cyanide Mills

JOHN ALLINGHAM

PAST EXPERIENCE HAS PROVED that no benefit is gained by adding mercury in any form to cyanide solutions in treating sulphide ores containing gold and silver. In fact, addition of mercury usually results in further loss of gold and silver. But as a result of these attempts it is evident that operators cyaniding gold-silver ores should use wooden tanks, natural rubber-lined pumps and pipes to prevent loss of gold—if the ore contains mercury.

Adding Mercury to Cyanide

Addition of mercury salts to cyanide solutions to increase gold extraction was first suggested by J. E. Clennell when he was chemist to Rand Central Reduction Co., South Africa. As a result, the following tests were made:

Mercuric chloride, (corrosive sublimate) was added to cyanide tanks by H. T. Durant, who was in charge of the plant treating the tailing dump of Grand Central Mining Co., La Colorada, Sonora, Mexico. This was the first plant in North America to add a mercury salt to cyanide solutions.

E. M. Hamilton was placed in charge of the operation after Durant left to take charge of Butters Tailing Plant at Virginia City, Nev.

Mercuric chloride was added to each alternate tank and after a careful check of sand residues and leach solutions, Hamilton came to the conclusion that the addition of mercury salt to the solutions was of no benefit and its use was discontinued.

Hamilton, however, recommended that mercuric chloride be added to cyanide solutions at the reduction plant of El Oro Mining & Railway Co., El Oro, Mexico. It is quite possible that Hamilton made laboratory tests on this ore, using a small amount of mercuric chloride in conjunction with potassium cyanide, and test results showed better gold extractions, but undoubtedly the solutions used were made with fresh water and not mill solutions.

After Hamilton left El Oro, the use of mercuric chloride was continued, small quantities of powdered corrosive sublimate being scattered on top of each charge in the leaching tanks. Mercury in the solutions was precipitated by zinc shavings in precipitation boxes with the result that much zinc became brittle and packed down in the compartments. Addition of mercury was stopped a short time later.

After El Oro started to use mercuric chloride in cyanide solutions, Francis J. Hobson made a series of tests on gold-silver concentrate. These tests, published in *Mexican Mining Journal*, showed very fast and excellent extractions were obtained by using mercuric cyanide in conjunction with potassium cyanide. Pilot plant was erected to try out the method, but no results were published.

In making tests by cyanidation of a silver ore, where silver was in the form of stephanite, I found that better extractions could be obtained by adding mercuric chloride to cyanide solution. After a treatment plant was built and placed in operation, I used mercury salt in cyanidation of the tailing from the concentrator.

For the first month of operation extraction of silver was very good, then extractions started to drop and after three months of operation, silver recovery was about the same as obtained by ordinary cyanide solutions in test work in the laboratory and pilot plant.

Mercury was added in different ways, as chloride, oxide and as mercuric cyanide. Laboratory tests proved that regardless of form in which mercury is added, formation of mercuric cyanide results. Mercury forms with cyanide, mercuric cyanide, which is soluble in water, perhaps the only metal cyanide soluble in water. All other metal cyanides form double salts with alkaline cyanides or are soluble in excess of alkaline cyanides.

After four months' operation, use of mercury was discontinued and a method was adopted that gave better extractions than those obtained using a mercury salt in test work.

In this method, concentrator tailings were reground by pebble mills with the addition of cyanide solution and lime. Pulp then passed through six agitation tanks in series and then thickened before filtration in a Butters stationary filter. After the pulp had passed through the first three agitation tanks, soda ash and lime was added to form caustic soda in the pulp. Amount of caustic soda had to be controlled carefully to obtain maximum silver extraction. By this procedure a practical recovery of 94% silver was obtained.

Why It Didn't Work

At the Butters Laboratory at Oakland, Calif. in 1916, I made tests on a representative tailings sample that the Butters Co. had been treating for some years at a cyanide plant, situated in Six Mile Canyon, Virginia City, Nev. While making these tests, I discovered that iron would precipitate mercury from cyanide solutions containing mercuric cyanide.

At this time I had the opportunity of studying the reactions of mercuric cyanide in cyanide solutions. As a result of this work, I was able to give the reason for the failure of mercuric chloride added to cyanide solutions to increase extraction in the cyanidation of silver sulphide ores when the solutions had been recirculated for some time and a regular mill solution formed.

When sulphide ores are treated by cyanidation, potassium or sodium thiocyanate is formed in solution, and when thiocyanate reaches a certain concentration, mercuric cyanide reacts with the thiocyanate forming mercury thiocyanate. Laboratory tests showed that mercury thiocyanate added to cyanide solutions has no beneficial effect in the treatment of silver sulphide ores. This explanation was published in the *Mining & Scientific Press*, together with results of assays of filings and scrapings taken from pipe lines and runners from pumps in the plant at Six Mile Canyon.

Mercury Lowers Cyanide Recovery

At this plant, I found gold, silver and mercury everywhere iron came in contact with solutions. An examination of mill records proved that an appreciable difference occurred monthly between theoretical recovery, based on head and tail samples from Butters filters and the actual recovery of gold and silver.

In some months this difference was as high as 20%. These large monthly differences can hardly be explained by errors in assaying or incorrect sampling, so loss of gold and silver must have been caused by precipitation of these metals on iron surfaces. For

Mr. Allingham is retired metallurgist, Fontana, Calif.

many years of operation of the plant, the presence of mercury was overlooked. In those days, complete analyses of ores were not made before test work as they are today. Nevertheless, it appears strange that many metallurgists did not recognize the fact that all tailing resulting from pan amalgamation or Patio Process had to contain insoluble mercurous chloride.

Amalgamation of silver chloride, an intermediate product of these processes resulted in the formation of mercurous chloride that was subsequently lost in the tailing. Other mercury losses occurred in the processes. Principal loss was due to entrainment of very fine particles of mercury in tailings. Loss of mercury was well explained by Federico Sonnesschmid, German metallurgist, in his *Tratado De La Amalgamacion*, published in 1825.

How To Check for Mercury

In many pannings from samples taken from this class of tailing, I have never seen any mercury in the concentrate. Mercurous chloride can be detected in the concentrate by adding a small amount of potassium cyanide or sodium hyposulphite to the pan. Then tiny globules of mercury can be seen with a magnifying glass, if mercurous chloride is present. Mercurous chloride is 50% soluble in cyanide or thiosulphate solutions forming mercuric cyanide or mercury thiosulphate and half the mercury contained in mercurous chloride changes to gray mercury or mercury in a fine state of division.

When the Butters plant in Six Mile Canyon started operation in 1902, cyanide solutions were electrolyzed to precipitate gold and silver, but a short time later, zinc shavings were used to precipitate. This change in precipitation was unknowingly a mistake as mercury contained in solution was never completely precipitated by the zinc. Mercury precipitated on the zinc becomes an active precipitant for gold and silver, mercury going into solution.

In electrical precipitation as it was practiced at Butters plant, La Colorada, Mexico, gold, silver, copper and any mercury were precipitated as sludge, and very little of the metals was deposited on the tinned iron cathodes. This sludge dropped to bottom of the cell boxes and any precipitated mercury had little chance of precipitating gold or silver, and of going into solution again.

Sometime before 1916, presence of mercury in the tailing dump in Six Mile Canyon had been recognized, as retorts had been put in to distill the mercury in the zinc precipitate before melting the precipitate into bars. However, when I went to Virginia City, this practice of retorting had been stopped as the amount of mercury reclaimed was too small to make operation profitable.

A few years later on the road to Grantsville, Nev., I passed the cyanide plant treating the Magdalena tailing. Cyanidation was carried out by leaching tailing in wooden tanks, and the leach solutions flowed through wooden launders direct to the precipitation room. After the solution had passed through sheet iron, it flowed through a small amount of zinc shaving, to complete the precipitation of gold and silver. Note that they used wooden, not iron launders.

Iron Precipitates Mercury

At the Santa Teresa Ranch, Guanajuato, Mexico, the tailing dump resulting from treating ores by the Patio process assayed approximately 700 gm mercury per metric ton. This was average assay of the great many samples taken by pit sampling and checked by a composite sample of some 300 samples from bore holes.

In treating this tailing, (1930 to 1932), either with cyanide or sodium thiosulphate solutions, mercury was precipitated in pipe lines, and on other iron surfaces.

Effluent from Butters filter assayed less in gold and silver than the solution in the pulp before filtration.

Filtered solution was agitated with zinc dust to precipitate the metals in solution and resulting precipitate separated by filtration. Precipitation of the mercury was never complete, as shown by assays of solution after precipitation. It was necessary to retort the precipitate wet, as mercury was lost in drying, even at very low temperature. Mercury in the precipitate starts to evaporate at about 80 deg C.

Lining the pipes with latex rubber to prevent precipitation was suggested by a rubber company, but this proved to be a failure. Vulcanized latex rubber was quickly disintegrated by solutions containing mercury and copper. But natural rubber and modern plastic coatings should be used to cover all bare iron over which the cyanide solution flows—if the ore contains mercury.

Preventive Maintenance for Mine Power Cables[1]

FIRST STEP in a mine cable preventive maintenance program is to inspect all circuits for overloads, poor thermal conditions, mechanical damage and inherent danger spots such as shafts, raises and haulageways. Use a hook-on ammeter to check for overload conditions.

Two most common causes of cable insulation failure are moisture and excessive heating. Excessive heating due to overloads or high external temperatures causes insulation to dry and crack, and this increases dielectric losses. Deteriorated insulation, if disturbed, will probably crumble and blow out the circuit. Hence, do not disturb an old broken down cable until a replacement is on hand.

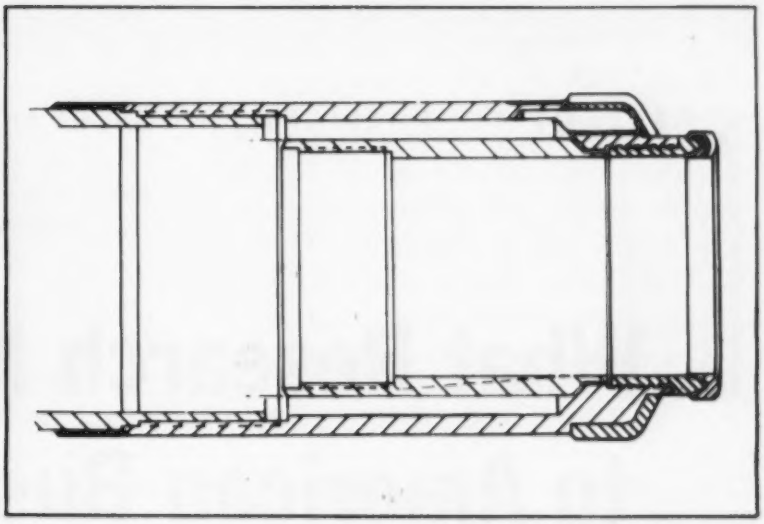
Next establish a yearly schedule for high-potential tests or megohmmeter readings. Since high-potential sets cost more than megohmmeter, most plants use megohmmeters. An electronic or motor driven megohmmeter is mandatory because readings usually take up to 10 min.

Your first megohm readings will probably mean very little to you—other than zero for a failed cable, or quite high for a good one. Be sure to keep careful records of connections used, temperature, megohmmeter used, date, who conducted test and other pertinent information. Record readings after 15 sec, 30 sec, and 1, 3, 5 and 10 min, or until there is no increase in reading. Temperature coefficient of insulation is negative and numerically large. As temperature increases, megohm value drops.

Remember, that if there is a consistent downward trend in readings, you are probably heading for an insulation failure. This proves the importance of keeping records on feeders. If after several annual checks, a cable shows signs of failure, more frequent checks should be made.

Here's a quick way to detect trouble: The ratio of the 3- or 10-min reading to the 1-min reading is called the polarization index. If this ratio is below 1.2, look out for trouble and inspect frequently!

[1]From an address by H. E. Heddesheime, maintenance consultant for General Electric Co., at the Eighth Plant Maintenance Show, Cleveland, Ohio.



MODIFIED PILOT-TYPE bit and no core lifter in swivel-type core barrel are two factors in—

Raising Recovery in Poor Coring Ground

"A NEW TWIST TO AN OLD IDEA" has boosted core recovery from 40-60% to 96.7% in very friable and poorly consolidated uranium-bearing sediments of Wyoming's Gas Hills area, according to Ned Miles of Christensen Diamond Products Co. in his paper delivered at Colorado Mining Association meeting in Denver in February.

Three Changes Are Key

Essentially, improvement comes from: (1) using a modified pilot type core bit which cuts down washing on pilot face; (2) eliminating core lifter; and (3) using mud as fluid at as little volume and pressure as possible.

Bit is diamond set type in which coring pilot portion has straight inner walls and reaming shoulder contains eight 5/16-in. dia face discharge ports. Shoulder is approximately one inch behind pilot face. Box type (female) thread is used to attach bit to core barrel. (See photo)

Core barrel is 3x4½-in. double tube swivel type, but core lifter assembly on inner tube is replaced with a straight wall inner tube shoe or extension (see drawing). Core lifter (i.e. bevel wall shoe) can be substituted in hard rock.

Performance reported by Lost Creek Oil & Uranium Co., Rawlins, Wyo. —maintaining and operating their own drilling set up—is as follows:

All units of Wind River formation successfully cored.

Footage averaged 25 ft of core per drill shift.

Recovery was 96.7% of total coring as of Dec. 1, 1956.

Costs totaled $11.50 per ft, consisting of $2.31 per ft combined bit and barrel costs and $9.19 per ft all other costs (labor, fuel, water, equipment, parts, amortization of rig and water truck.)

Coring was done with Failing CFS-1 drill using 2⅜-in. drill pipe at depths between 170 and 260 ft inside a 5½-in. hole. Weight on diamond bit was estimated to be 3,500 to 4,000 lb. Crowding the bit with weights greater than this did nothing except block run short of five-foot objective, which was the exception rather than the rule anyway. Idea, as in any coring operation, is to keep bit penetrating at a reasonable rate and, at same time, to apply sufficient weight to prevent the bit from vibrating on bottom of hole. Core barrel rotation averaged approximately 45 rpm, since it was felt that optimum results were being obtained at this point.

Air Didn't Work

Practicability of using air was thoroughly tested and proved not feasible. Even at low pressure (30 to 35 lb), air had tendency to blow bottom of hole out and cause considerable caving from above. Water base mud mixture of about 40 to 45 viscosity seemed to be answer because it gave carrying power necessary to transport cuttings to the collar of hole. Pump on rig is a 5x6 duplex with 3-in. liners, output of which could be controlled very closely with the transmission.

Mud Flow Is Critical

Mr. Miles says importance of circulation volume cannot be over-emphasized in an operation such as this. Drill operators in the same area complain about "no core" with conventional barrels and at the same time run a 5x6 or 5x8 pump unrestricted. Large volume cannot be circulated in loose sand such as the Wind River without affecting core recovery. For this reason pump volume and pressure were cut down as far as was thought possible without gambling too much.

Extracting core from inner tube was done hydraulically by connecting wash line from pump to back end of inner tube by means of 1-in. pipe connected to 3-in. inner tube sub. A protective plunger was used between core and fluid to prevent erosion of core. This eliminated standard practice of pounding on tube in spite of the moisture adsorption swell of bentonite in Wind River formation. The record mentioned above is proof of the success.

What Research Means to American Business

American industry plans to invest $150 billion in new plant and equipment during the next four years—more than in the five years 1952-1956. It plans to carry out this record investment even though manufacturing capacity has nearly doubled since World War II. These facts are reported in McGraw-Hill's tenth annual survey of Business' Plans for New Plants and Equipment. They contradict many long-established theories about investment in capital goods.

According to the textbooks, a high and rising level of capital investment is generally followed by a decline. The bigger the rise—so the old theory goes—the bigger the decline will be. But, after a decade of high-level investment and an especially strong rise in the past two years, industry now has plans to keep right on with near-record outlays for plant and equipment. Does this mean some new factor has been added, to change the investment cycle?

The New Factor—Research

The latest McGraw-Hill survey points out one new factor which, more than any other, is changing the nature of the investment process. This is the record outlay planned by U.S. corporations for **scientific research and development**—to create new products and develop new industrial processes. The rapid growth of research in industry, and plans for even more remarkable growth in the years ahead, are shown by the accompanying table.

This year industry plans to spend $7 billion on research and development — up 20% from 1956. By 1960 it will spend $9 billion — enough to create a major new industry.

By 1960 manufacturing industry expects sales to be up 26% — with half the increase in products that were not made in 1956.

Growth of Research and Development Expenditures

(Millions of Dollars)

	1955	1956	PLANNED 1957	PLANNED 1960
Machinery	408	506	577	704
Electrical Equipment	950	1,149	1,310	1,637
Aircraft and Parts	1,038	1,558	2,274	3,161
Fabricated Metal Products and Ordnance	134	165	174	210
Professional and Scientific Instruments	185	252	300	453
Chemicals	440	498	528	617
Paper, Rubber, Stone, Clay and Glass Products	149	174	196	233
Petroleum Products	171	205	225	277
Other Manufacturing	1,038	1,279	1,388	1,557
Non-manufacturing industries	254	310	347	419
ALL INDUSTRIES	4,767	6,096	7,319	9,269

What Research Is Doing

Here are some examples of how industrial research is opening up new markets, or compelling the modernization of old facilities:

New automatic controls in petroleum refining will raise the quality of gasoline and reduce the time required for production. A new process for recovering oil from depleted wells promises to multiply our potential reserves.

A new process for treating iron ore will permit the ore to be fed directly into steel furnaces—without the need for blast furnaces or coke ovens.

New turbine engines—made possible by the development of heat-resistant alloys for turbine parts—offer greatly increased power for aircraft, ships and automobiles.

Altogether, industry plans to introduce more new products in 1957-1960 than in any previous four-year period. It also plans new processes on a scale that will make much of our present capacity obsolete. These new products and new processes are the secret behind continuing plans for high investment.

One-third of all manufacturing firms are building new plants this year to produce new products, and by 1960 this may account for 10% to 20% of all capital expenditures. At the same time, manufacturing companies report that over half their capital expenditures in the next four years will be for modernization of equipment and introduction of new processes. Thus the preponderant share of new investment will be based on developments growing out of research.

A New Kind of Prosperity

The keen interest of U. S. business firms in scientific research points the way to a new kind of prosperity for our economy—a prosperity based on deliberate creativeness. As long as we can create new products that will offer better value to consumers or cut costs to manufacturing firms, business will continue at a high level—not at fever pitch, perhaps, and it is to be hoped not at an inflationary pitch. But based on a steady stream of new products and processes, we can have a high level of general prosperity that defies the old laws of boom and bust.

It's Not Automatic

Of course, there is no guarantee. New products do not spring up by magic as the medieval alchemists hoped they would. They are found as the result of long and expensive effort in laboratories and pilot plants. This effort requires an increasing number of trained scientists and engineers. In 1957 alone, manufacturing companies report they will need 7% more of these highly trained people in research and development. And by 1960, they will need an additional 15% to carry out planned research programs.

The effort to maintain prosperity — as well as the national defense effort — will depend increasingly on this supply of scientific and technical personnel. But if we can supply the people, industry now has the plans for a research effort that will put an end to the spectre of idle plants and idle workers.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

PERSONALS

Thomas J. Babson, assistant mine superintendent, Braden Copper Co., Sewell Chile, has been named mine superintendent, succeeding **I. Casarrotto** who has retired after more than 30 years of service with the company.

Stanley de J. Osborne has been named president and chief executive officer, and **Thomas S. Nichols** has been named chairman of Olin Mathieson Chemical Corp. **John M. Olin** will become chairman of the financial and operating policy committee and will continue to serve as chairman of the executive committee.

Ezra J. Kennedy Jr., assistant secretary of the American Institute of Mining, Metallurgical and Petroleum Engineers, has retired. He served on the headquarters staff in New York for 31 years and was editor of AIME Transactions and secretary of the Technical Publications Committee.

Edward S. Frohling, former mill manager for St. Lawrence Fluorspar in Wilmington, Del., has joined Western Machinery Co. in New York as consulting metallurgical engineer.

The Institute of Mining & Metallurgy has presented its 1956 Gold Medal to **Randolphe William Diamond,** vice president and general manager of the Consolidated Mining & Smelting Co. of Canada, Ltd., for "distinguished services to the mineral industry in Canada."

Philip D. Wilson has been elected a vice president of Callahan Zinc-Lead Co. Mr. Wilson, who last year was re-elected president of the Mining & Metallurgical Society of America, is a consulting mining engineer and geologist.

Robert R. Durk, former general superintendent of Standard Uranium Corp., Moab, Utah, has joined Sanford-Day Iron Works, Inc. as manager of sales, mining equipment. Mr. Durk has a B.S. degree in mining engineering from the University of Idaho.

R. E. Powell, president of the Aluminum Co. of Canada, Ltd., has retired as president but will remain active in the company as senior vice president of Aluminum Ltd. **Fraser W. Bruce** has been elected president succeeding Mr. Powell. **Melvin P. Weigel** has succeeded Mr. Powell in his position as director of operations of Aluminum Ltd.

F. X. Tartaron, now Professor of Mining Engineering at the University of Pittsburgh, has received a grant of $24,500 from U.S. Steel Corp. for basic research in beneficiation.

Leonard F. Wright, Vancouver consulting metallurgist has been nominated as chairman of the British Columbia section of the Canadian Institute of Mining & Metallurgy.

N. P. Arnold, plant superintendent, has been promoted to superintendent of maintenance for the W. S. Moore Co.

Leach

Entrekin

E. P. Leach has been appointed general manager, mining division, Bethlehem Steel Corp. Joining Bethlehem in 1941 in the company's Chile operations where he served successively as mine superintendent, assistant manager, and from 1950 to 1954 as vice president and manager, he returned as assistant to the vice president of the mining division in 1954. **P. B. Entrekin,** general manager since 1949, has been named a director of Bethlehem, and assistant vice president of the mining division. He joined Bethlehem in 1926 and served as vice president of the company's Chile operations from 1944 to 1949.

S. D. Strauss, vice president and manager of sales, American Smelting & Refining Co., has been elected president of the American Zinc Institute. Three vice presidents elected were: **J. D. Bradley,** the Bunker Hill Co.; **Clarence Glass,** Anaconda Sales Co.; and **H. L. Young,** American Zinc Sales Co.

Charles M. Brinckerhoff has been elected a director of the following Anaconda Co. subsidiaries: Andes Copper Mining Co., Chile Exploration Co., and Chile Copper Co.

CLYDE E. WEED, president of the Anaconda Co., was presented the award of Knight Commander of the Order of Merit of Bernardo O'Higgins, Chile's highest decoration for foreigners who have rendered great service to the country, by Acting Minister of Foreign Affairs Gustavo Luco (right) and Ramón Rodrígues (left) Director of Protocol.

Henry L. Hill, consulting mining engineer, was re-elected president of the British Columbia and Yukon Chamber of Mines, at its annual meeting. Vice presidents elected were **J. A. Pike** of Newmont Mining Corp. of Canada, Ltd., and **Desmond N. W. Grubb** of the Imperial Bank of Canada.

Donald L. Mosher has been named plant superintendent at Vitro Rare Metals Co., Canonsburg, Pa.

John G. Strohl has been named general manager of the Camp Bird Mine at Ouray, Colo.

Harlan G. Bower, editor of *Chinorama,* the Chino monthly employee magazine since its inception nearly two years ago, has been appointed to the newly created post of director of communications for Chino Mines Division of Kennecott Copper Corp., Hurley, N. M. **A. J. Jacobs** has joined the staff of the labor relations department for the division.

J. Clark Henry, superintendent for the Charleson Iron Mining Co. in Virginia, Minn., has retired, but will be retained in a consulting capacity. He has been actively engaged in mining in Minnesota, Alaska and other areas for over fifty years.

L. H. Lange, vice president of the Galigher Co., Salt Lake City, Utah, has returned to the U. S. after a 10-month trip visiting mining districts in the Philippines, Australia—where he is consulting metallurgist for Mt. Isa Mines—in South West Africa—consulting metallurgist for Tsumeb Corp.—in the Belgian Congo, the Rhodesias, and at operations in French Morocco.

Arthur L. Anderson, assistant treasurer, for the Oliver Iron Mining Div. since 1949 has retired after nearly 50 years of service with the company.

Alva A. Erickson, master mechanic at the Webb mine of Snyder Mining Co. has been promoted to mechanical superintendent for the company's Mesabi Range mines.

William Klein, assistant superintendent, has been named superintendent, Carlton Mill, Cripple Creek, Colo. of Golden Cycle Corp., succeeding **Howard Keil,** who has accepted a similar position for Kerr-McGee Corp., Grants, N. M.

Sir Edwin Plowden, chairman of the United Kingdom Atomic Energy Authority, has gone to South Africa to meet the country's atomic energy experts, especially those concerned with its development, and also those concerned with mining uranium.

Woodman Perine, director of Vitro's Silver Spring Laboratory, Md., has been elected to the new office of president of Vitro Engineering Co. Mr. Perine replaces **Richard A. North,** general manager of Vitro Engineering Div. since 1954, who has resigned.

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PERSONALS *(Continued)*

American Smelting & Refining Co. has announced the following changes in top management. **Kenneth C. Brownell** has moved up to chairman of the board from president; **R. Worth Vaughan** has become president; **Oscar S. Straus** was elected chairman of the finance committee. Retiring are **Roger W. Straus,** board chairman, who will remain as a director; and **John C. Emison,** finance committee chairman. Two new management directors and a new company vice president were elected. **R. D. Bradford,** vice president and **Forrest G. Hamrick,** who has also been made treasurer, are directors. **Kershaw Harms** has been elected a vice president. Mr. Brownell joined the company in 1927, became executive vice president in 1947 and in 1949 was named president. Mr. Vaughan joined the firm in 1937 as assistant general counsel. He was named vice president and general counsel in 1947, a director in 1948 and executive vice president in 1955. Oscar Straus joined the company in 1946 and was elected vice president and treasurer in 1955. Mr. Bradford is president of the subsidiary, Lake Asbestos of Quebec, Ltd., and a vice president of the parent company. He has been with the company for more than 30 years.

Brownell

Vaughan

Straus

T. M. Hunter has been named assistant to the vice president of operations for U.S. Steel Corp. He will be concerned with the planning for all mining and manufacturing facilities of the corporation on a nationwide basis.

Guy Finlayson has accepted an appointment as ore dressing expert with the Technical Assistance Administration of the United Nations, to advise the government of Turkey in the field of ore dressing.

Robert H. Carpenter, geology professor at Colorado School of Mines, has left for Florence, Italy, to study for a year under a Fulbright fellowship. He will do research on ore deposition in limestone.

Morris L. Bradt, general superintendent for Pickands Mather & Co. in the Hibbing district, has retired April 1, after 35 years of service with the company. **T. C. Thielman,** general superintendent of the east Mesabi district, succeeds Mr. Bradt. **R. T. Bell,** assistant to the general superintendent, has been promoted to assistant general superintendent.

Robert M. Haldeman, vice president and general manager of Braden Copper Co. in Chile, has been awarded the Chilean order Pour Le Merite for distinguished services rendered to Chile during the 16 years he has worked at El Teniente mine.

Judson H. Whitman has been appointed mining engineer in the rare earths and thorium division of Michigan Chemical Corp. A graduate from the Montana School of Mines in 1947, he was formerly with Anaconda at Ketchikan, Alaska; Pend Oreille Mines & Metals Co.; a geologist for American Zinc, Lead & Smelting Co.; and from 1952 to 1956 he was with Cia Mineray Refinadora Mexicana, S.A., a subsidiary of National Lead Co.

Harold Andrews, production superintendent of the Lithium Corp. of America plant at Bessemer City, N.C., has been transferred to St. Louis Park, Minn., as plant manager. **Edward Golob,** former assistant superintendent of the Bessemer City plant, has been named to succeed him, and **Donald Wirick** has been promoted to assistant production manager at Bessemer City.

Robert G. Page, president of Phelps Dodge Corp., has been elected a director of the New Jersey Zinc Co.

Roy E. Nelson, engineering graduate of Massachusetts Institute of Technology, has been named a vice president of American Gilsonite Co. He is manager of production for the company.

John H. Bassarcar has been named mill superintendent at National Lead Co's MacIntyre Development in Tahawus, N.J. A graduate of the Colorado School of Mines in 1950, Mr. Bassarear worked for Anaconda at the Great Falls operation before coming to Tahawus in 1951 as metallurgist and assistant mill and sinter plant superintendent.

St. Joseph Lead Co. has announced the following staff elections: **Norman H. Donald Jr.,** manager of explorations; **C. DeWitt Smith,** assistant vice president; **Robert H. Ramsey,** assistant vice president; and **Donald K. Lourie,** secretary.

Leo L. Lewis has been appointed production manager of National Lead Co.'s titanium division, succeeding **C. Y. Pfoutz,** retired.

Ray L. Schultze has been appointed general superintendent of Rio De Oro Uranium Mines, Inc. He had been assistant general superintedent at Hidden Splendor Mine Corp.'s Delta Mine.

Walter Hochschild, president of the American Metal Co., Ltd., has been elected chairman, effective Aug. 1, to succeed **Harold K. Hochschild** who will retire to become honorary chairman and will remain a director. **Hans A. Vogelstein,** vice president and treasurer, was elected president; Herbert S. Cohen, vice president and controller, was placed in charge of finance and **Donald J. Donahue,** assistant treasurer, was elected Treasurer; and **Erwin A. Weil,** assistant secretary, was elected secretary, all effective Aug. 1.

Hermann K. Intemann has been appointed president of Electro Metallurgical Co., Div. of Union Carbide & Carbon Corp. Joining Union Carbide in 1930, he had been executive vice president of Electro Metallurgical Co. since 1956.

OBITUARIES

Cornelius F. Kelley, 82, former chairman of the board of the Anaconda Co., died on Sunday, May 12, at Columbia-Presbyterian Medical Center following an operation. Mr. Kelley retired as board chairman in 1955, but remained as chairman of the executive committee. He was born in Mineral Hill, Nev., February 10, 1875, and began his career in copper, after his family had moved to Butte, Mont., as a member of an Anaconda surveying gang. Chronologically, his career developed as follows: in charge of survey and underground mining for Anaconda; studied law at the University of Michigan; practiced law in Butte; member of the Montana House of Representatives 1899-1901; member Anaconda legal department; named general counsel in 1908; named director and vice president in 1911; named president in 1918; and elected chairman of the board in 1940. He had been chairman of Andes Copper Mining Co., the Chile Copper Co., and the Chile Exploration Co., and president and director of nine other organizations allied to the copper industry.

Kelley

Otto Haentjens, founder and president of Barrett, Haentjens & Co., Hazleton, Pa., died March 13.

ACKNOWLEDGMENT

E&MJ wishes to acknowledge credit to Carpco Manufacturing, Inc., of Jacksonville, Fla., for permission to publish the diagrams copyrighted in 1955 of the Carpco high tension and magnetic induced roll separators shown at the beginning of and discussed in the article by J. E. Shelton and W. A. Stickney entitled "How to Process Alluvial Sand for Tantalum-Columbium" on p 93 of the April 1957 issue.

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Annual Reports—Mining's Growth

Chief Consolidated Mining Co. reports that Bear Creek Mining Co., Kennecott's subsidiary, is actively exploring Consolidated property in the East Tintic district. Shaft has passed 200-ft level and will bottom at 1,050. Chief Consolidated will treat some ore from Chief No. 1 that was by-passed years ago. Company operated through 1956 with $22,916 loss before depreciation.

Consolidated Coppermines Corp. and its subsidiaries, Titan Manufacturing Co. and Rockbestos Products Corp. had 1956 income of $9,325,673 and net profit of $5,693,967 from total sales of $61-million. Mining division provided 57% of net income. Mine development expenditures were $3.7-million. Consolidated will spend some $7-million in company-wide expansion in 1957 and 1958.

Of copper ore shipped to smelter, 83.7% came from Tripp Pit. Total production was 3,180,713 tons ore.

Consolidated is establishing an exploration office in Canada.

National Lead Co. had net sales of $576,292,383 for the year and net income of $63,152,087. Company transferred Fredericktown nickel reduction works to U.S. Government and then leased it back for 6 years. National Lead plans to spend $15-million to increase titanium dioxide capacity by mid-1958.

Joint venture with Republic Steel Corp. has developed a new iron from ore process. New corporation has been formed to develop commercial process.

Nickel Processing Corp., subsidiary of National Lead, started conversion to nickel metal from nickel oxide sinter at Crum Lynne, Pa.

National also purchased majority interest in Pioneer Aluminum Inc., maker of zinc and aluminum aircraft products. Company has joined with nine other companies to form Industrial Reactor Laboratories, Inc., to build a nuclear reactor.

National Lead also took over operation for the AEC of Monticello uranium mill.

Titanium Metals Corp., 50-50 deal with Allegheny Ludlum Steel Corp., reported sales at $38,310,000 and net income of $11-million. TMCA expanded capacity of Henderson, Nev., plant to 6,000 tons sponge, and plans further expansion to 9,000 tons sponge and 11,000 tons ingot per year. New capacity will be available by Fall.

Canadian Titanium Pigments, Ltd. is 50% complete (total cost will be $15-million). Nicaro nickel expansion program is completed—capacity is 50-million lb per year. And National Lead has formed barytes mining operation off coast of Brazil and has acquired substantial interest in processing facilities now being built in Venezuela.

National Lead has expanded Australian rutile production and concentrating units, and is building a new concentrator at Port McQuarie, through Mineral Deposits, Pty. Ltd., subsidiary formed in 1955.

Copper Range Co. and its wholly owned subsidiary White Pine Copper Co. showed consolidated net sales of $49,387,988 and net income after taxes of $9,155,972 for year 1956. During the year, Government loan of White Pine was reduced $7,504,602 from $59,-100,876. Production at White Pine totalled 75,516,312 lb refined copper. No deliveries were made to U.S. Government under White Pine's procurement contract.

Copper Range's Champion mine shipped 400,787 tons to Freda concentrator, whose copper output for the year was 4,909,900 lb.

Vitro Corp. of America entered into a new uranium milling contract with AEC, covering Salt Lake facilities until 1962. Vitro's capital expenditures in 1956 amounted to $2,540,000, while company sales reached $40,898,531 and net income was $617,515. Vitro completed the acquisition of Thieblot Aircraft Co., Berkshire Chemicals, Inc., and the Green River property of Uranium Prospectors Co. Ltd.

Vitro will pilot a manganese production process in a joint venture with Sheer-Korman Assoc., Inc. and Great Divide Mining & Milling Corp. Joint venture will be called U.S. Manganese Corp. Vitro Minerals Corp., a subsidiary, joined Ventures Ltd. to form Bolivex Corp., with plans to explore for minerals in Bolivia.

Vitro Uranium Co. will switch Salt Lake plant to solvent extraction. And Vitro Minerals Corp.'s Gas Hills uranium reserves are at least 250,000 tons. Refinery Engineering Ltd., is operating in Canada. Heavy Minerals Co. (40% Vitro) completed processing plant at Chattanooga in January 1957. Heavy Minerals conducts dredging operations in South Carolina and Florida. Vitro Minerals Corp. is prospecting for titanium, manganese, tungsten, mercury, asbestos and columbium-tantalum as well as uranium.

Standard Uranium Corp. told stockholders that company's Mamie claims in the Big Indian district contained 500,000 tons, with over 125,000 tons running 0.2% U_3O_8. Standard and Uranium Reduction Co. did the drilling. Standard and Col-U-Mex Uranium Co. have discovered an orebody on claims lying south of Standard's Big Buck mine. Company will drift in from the canyon rim. At the Big Buck, Standard has 120,000 tons in sight.

Shattuck Denn Mining Corp. and its wholly owned subsidiaries showed net profit in 1956 of $740,242. Company mined and milled over 250,000 tons from the Iron King mine. Capital expenditures were $149,099. Iron King provides most income. Uravan uranium mine operated during year, and annual report shows that Shattuck Denn produced 46,292 lb uranium and 247,078 lb vanadium. Fluorspar mill in New Mexico remained idle.

Calaveras Cement Co. net sales were $12,067,984, with net income of $1,436,-604. Capital expenditures were $3,668,-174. Calaveras' third major expansion was completed last summer. Capacity at San Andreas is now 4.3-million barrels. Included in recent expansion was a 360-ft fifth kiln and additional raw and finishing equipment, eight new silos and a Cottrell dust collector.

Capital Lithium Mines Ltd. reports that 38,995 ft of drilling in 72 holes show indicated 2,297,000 tons, 1.3% Li_2O on company's Sioux Lookout claims. Company also did exploration work for base metals in same area.

McIntyre Porcupine Mines Ltd. had consolidated net earnings of $2,887,905. At McIntyre Porcupine, total value of production was $7,432,530. Ore reserves stand at 2,518,563 tons, 0.3 oz Au. Belleterre Quebec Mines Ltd. treated 105,367 tons and recovered a gross value of $1,030,669. Ore reserves stood at 38,840 tons, 0.27 oz Au. Castle-Trethewey Mines Ltd. mined and milled 13,162 tons, recovered 30.37 tons of silver, plus additional cobalt. Broken ore reserves were 2,184 tons, 54.2 oz Ag.

Madsen Red Lake Gold Mines Ltd. produced bullion valued at $3,494,386, from which the company derived a net income of $779,375. Ore reserves stood at 87,700 tons, 0.3 oz Au. Exploration work was conducted in New Brunswick area, where 157 claims have been optioned to Mining Corp. of Canada Ltd., and 17 retained by Madsen. Work will be conducted this summer along Alaskan Highway, where mineralized float discovery has been made. Company also has work underway in Manitoba and Saskatchewan.

Vanadium Corp. of America celebrated fifty years of operation with the highest sales and earnings in their history—$64,343,000 net sales and $5,946,000 net income. Earnings were due to high rate of steel alloy production (estimated 10.3-million tons in 1956) and the expansion of the chemical, aluminum and titanium industries. Vanadium Corp. increased chrome production from Rhodesian Vanadium Corp. and continued to explore and develop Bahati manganese concession in Northern Rhodesia. Company was granted a 2,460-sq mile manganese concession in Northern Rhodesia.

On Colorado Plateau, Monument Valley No. 2 will expand the upgrader. Company leased uranium claims in Marysvale and Long Park areas. Exploration work continued at company's idle vanadium mine in Peru.

(Continued on page 222)

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CT-L-16

OPERATING IDEAS

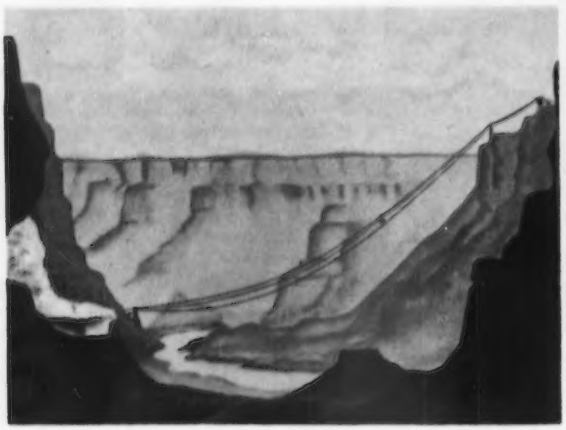
Hook Eases Dump Truck Repairs

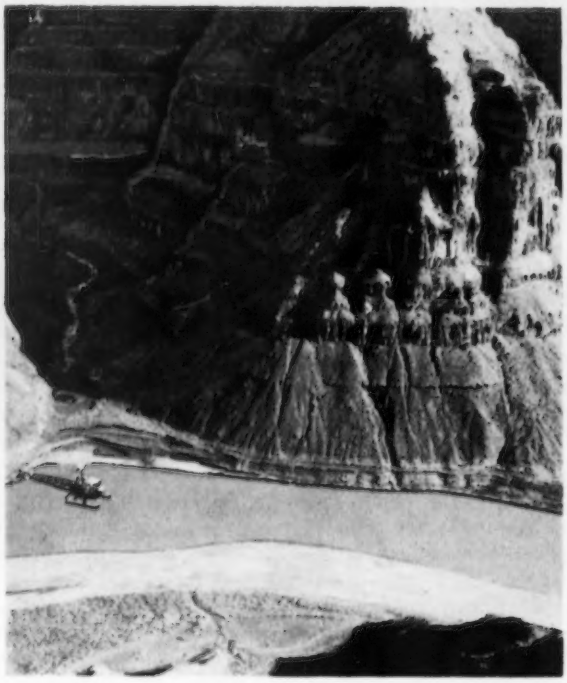
HOLDING dump truck body in raised position while working on wheels and hoist is the problem solved by this large removable steel hook. It was devised by Sam Saunders, garage foreman at Veteran shops, Nevada Mines division of Kennecott Copper Corp., McGill, Nev. Simple device replaces usually inconvenient timber blocks, crane hoists, etc., according to original article in *Kennevadan*, monthly employee magazine.

Pair of small hooks are welded to dump body under dumping lip. These hooks receive "T" lugs on one end of large hook. Other end of big hook is designed to engage stone guard between rear wheels.

To use, body is raised, hook is placed and then hoist slacked off. Weight of body holds hook in place.

Hook is 1-in. thick cut from 12x30-in. steel plate. Minimum width at any point is 3 in. "T" lugs are 1¼-in. dia rod.





AERIAL TRAMWAY will bring bat guano out of almost inaccessible Grand Canyon. Right: helicopter pays out ⅛-in. construction cable from cave at upper right.

Tramway and Vacuum Cleaner Solve Unusual Mining Problems

WORLD'S LONGEST single-span aerial freight tramway and a giant vacuum cleaner will soon tap an estimated 100,000 tons of bat guano in a cave in the Grand Canyon, Ariz.

Engineers of U. S. Steel's Consolidated Western Steel Div., working with New Pacific Coal & Oils Ltd., Toronto, Can., developed plans for aerial tramway now being erected. It runs from mouth of cave in canyon wall—600 ft above Colorado River—to canyon rim—9,400 ft across gorge and 2,300 ft higher.

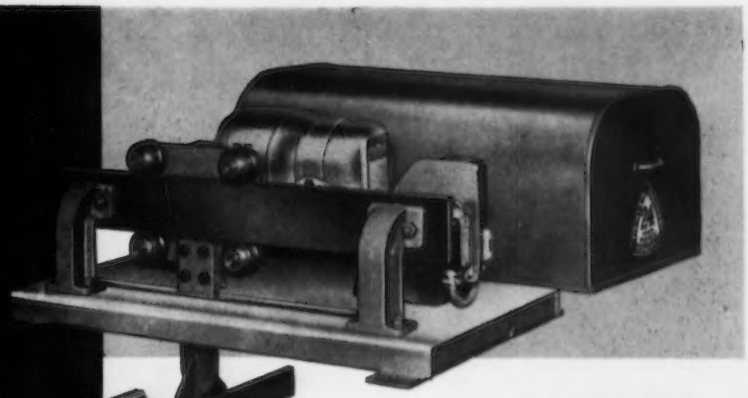
One of the difficult phases of construction is over. This was spectacular stringing by helicopter of 11,500 ft of ⅛-in. cable—first of four cables which must be drawn across gorge before permanent 1½-in. track cable is finally suspended from the three support towers. Stringing was expected to be finished about May 1, according to Stanley Farwell, construction superintendent for Consolidated Western.

U. S. Steel is building entire carrier from drawing board to completion. Wire rope was fabricated by Columbia-Geneva and American Steel & Wire Divs.

Guano occurs in powder form and will be picked up by a suction device, carried through 10-in. pipe, discharged into bag house and then dropped into loading bins at lower tramway terminal. At rim terminal it will be packaged in containers, flown to Kingman—about 60 miles, and shipped by rail from there. Production will be limited to 10,000 tons per year unless uncompleted exploration proves more.

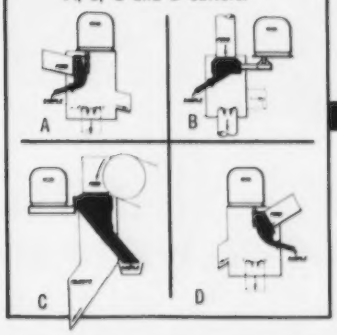
Bat Cave was discovered in 1930's and is claimed only commercial guano deposit in North America. Guano is in powder form and can be used in natural state as high-grade, odorless, organic fertilizer containing 10 to 16% nitrogen with considerable phosphate and potash. It may have additional value as source for drugs. New Pacific leased it from Department of Interior in March 1955. Previous attempts at barge and helicopter haulage were unsuccessful.

DENVER *Automatic* SAMPLERS



A Simple, Low Cost, Dependable and Accurate Unit— Few Moving Parts— No Maintenance.

IN STOCK - - - -
Standard duty 16", 21", 24" and 30" cutter travel units and standard type A, B, C and D cutters.



ONLY ONE LIMIT SWITCH

Simple design requires only one limit switch. Simplifies wiring circuit. Electrical problems stemming from switches are cut one half.

GEARMOTOR DRIVE

The gearmotor drive is operated in only one direction and the cutter travel is limited by a magnetic brake. Eliminates complicated switches and wiring that is required when motor is reversed.

FRICTION-FREE CUTTER TRAVEL

Cutter is carried on ball-bearing carriage wheels that roll on rigid, cold-rolled steel track. Eliminates wearing, metal-to-metal sliding or screw contact. Carriage is driven by heavy roller chain with DOUBLE pins which eliminate eccentric load on chain.

EASY-TO-SET TIMER

Simple Telechron driven, automatic reset timer regulates sampling interval. Timer setting can be easily changed at any time by shifting the fingers on the dial. No changing of gear trains.

Individual Sampler or Complete Sampling System

Standard duty units are kept in stock. Heavy duty units suitable to carry special cutters weighing several hundred pounds are available with cutter travel to 10' and longer.

Wet, dry, dust-tight units, multi-stage sampling, continuous cutter operation or intermittant automatic operation is available.

Dimensional drawings and specification sheets are available to assist in preliminary design layouts.

H. L. MINISTER, DECO Sales Engineer with many years' mining and milling experience, is available to assist you with your problems; in sampling, or any phase of your mill operation. Denver Samplers are described in detail in Bulletin No. S1-B4. A copy will be sent you on request.

"The firm that makes its friends happier, healthier and wealthier"

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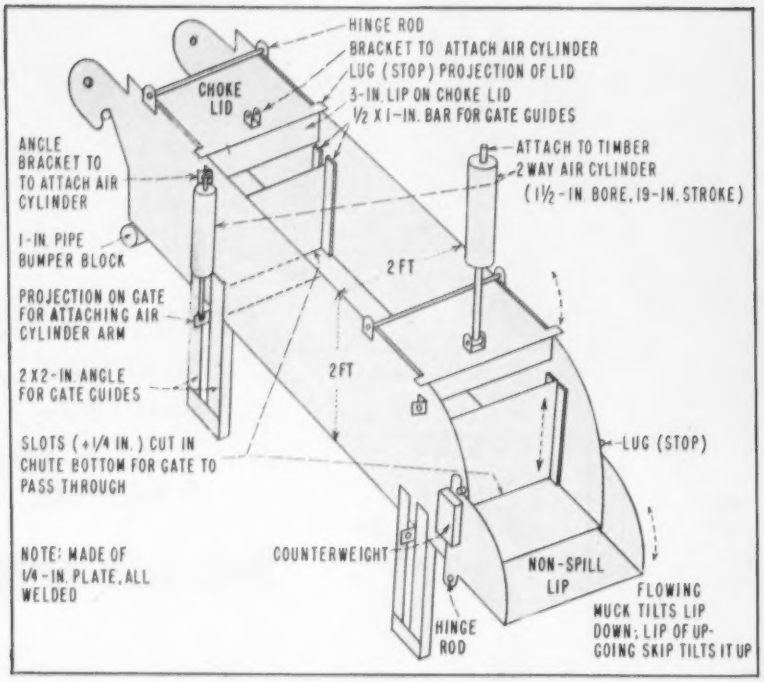

HINGE ROD
BRACKET TO ATTACH AIR CYLINDER
LUG (STOP) PROJECTION OF LID
3-IN. LIP ON CHOKE LID
½ X 1-IN. BAR FOR GATE GUIDES
CHOKE LID
ANGLE BRACKET TO TO ATTACH AIR CYLINDER
ATTACH TO TIMBER
2 WAY AIR CYLINDER
(1½-IN. BORE, 19-IN. STROKE)
1-IN. PIPE BUMPER BLOCK
2FT
PROJECTION ON GATE FOR ATTACHING AIR CYLINDER ARM
2FT
2X2-IN. ANGLE FOR GATE GUIDES
SLOTS (+1/4 IN.) CUT IN CHUTE BOTTOM FOR GATE TO PASS THROUGH
LUG (STOP)
NOTE: MADE OF 1/4-IN. PLATE, ALL WELDED
COUNTERWEIGHT
NON-SPILL LIP
FLOWING MUCK TILTS LIP DOWN; LIP OF UP-GOING SKIP TILTS IT UP
HINGE ROD

Prefab Chute Is Handy for Small Shaft

PUT TOGETHER from scrap and mail order air cylinders and valves, this chute was useful for an exploration project of Idaho Mining Co., in Coeur d'Alene district. Bruce E. Allgaier, managing engineer, says it is easy to move, and it speeded up hoisting cycle and cut spillage.

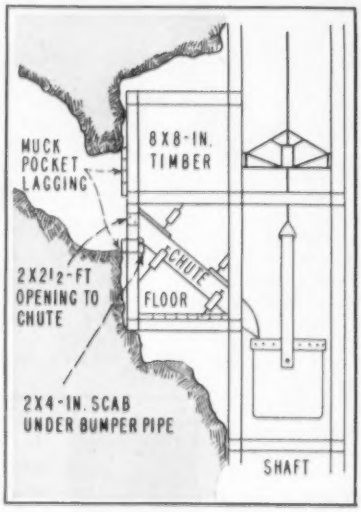
In placing, entire chute is lowered down shaft, discharge end up. Hooked end is pulled aside and hooked over ¾-in. bolts, well started in both posts where chute is to be installed. Chute is lowered until lip end rests on wall-plate. Finally two bolts or lag screws are put through holes (just above hook in chute side plate) and into posts. Removal of chute is similarly easy.

Cylinders were bought from mail order house for about $20 each. Stroke was shorter than the full 2 ft desired but cost was about one-fifth of any that could be found. On first trials muck jumped shorter gates so choke lids were added. They proved better design than any open gate for cutting spillage. Spill was a real problem because of small shaft sump below pocket.

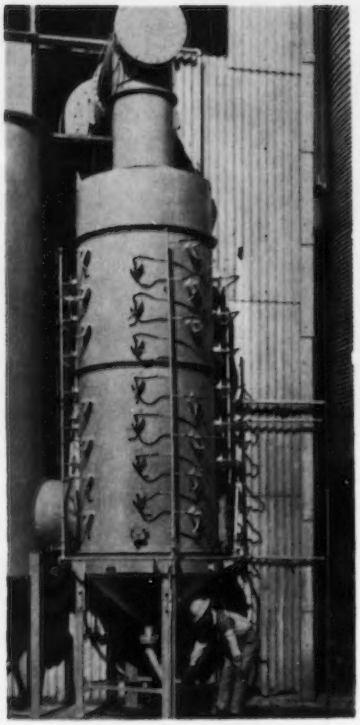
Four 3-way valves (war surplus, hydraulic) are used to control gates and lids. One controls two cylinders on front gate; another controls the two on rear gate. For proper action, air lines from one valve to pair of gate cylinders must be identical in length and design. Each of other two valves controls one choke lid cylinder.

Originally, controls were arranged to activate both gate and lid with one valve. This was changed to separate valve for each to avoid clamping a boulder between gate and lid which allowed fine muck to dribble past.

Before chute was developed, round-trip hoisting cycle was 10 to 12 min with frequent delays caused by rock jam-ups and frequent down time for sump clean-up—about one day in ten, for the latter. With the fast, non-clogging, positive cut-off action of chute, plus the overhanging lip, cycle was reduced to 8 min with no delays and one sump clean-up about every three months.



SETUP is simple and can be varied.



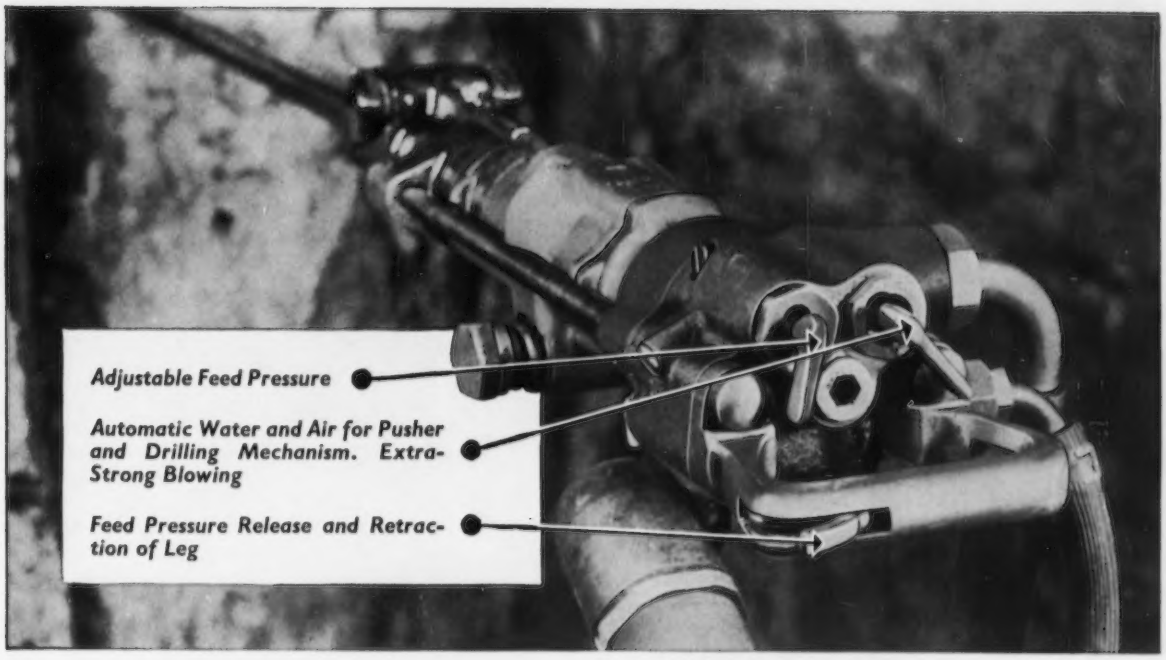
Corrosion-Abrasion Problem Solved

NEOPRENE LINING for a hot acid fume scrubber ended a costly search by Lithium Corp. of America at their new Bessemer City, N. C., plant.

To extract lithium, ore is pulverized, pugged with sulphuric acid and roasted in rotary kiln. This converts lithium mineral to lithium sulphate which is later leached. Gases leave kiln at 500 deg F. and pass through brick- and lead-lined pre-cooler where Teflon nozzled water sprays lower temperature to about 140 deg F. Gas then enters bottom of scrubber tangentially where carbide tipped water sprays remove SO_3 and dust.

Dust and acid cut oxide film from stainless steel and caused failure of several scrubbers in matter of months. Two types of resin linings were tried and one failed in a few weeks, the other in a few days. A coated fan and stainless steel ductwork above scrubber also corroded rapidly. Four fans failed in six months.

In July 1955, neoprene lining was applied to scrubber, ductwork and fan. After one full year of operation, equipment was still intact. Scrubber was relined in July 1956 but only because accidental loss of water to precooler exposed scrubber to direct heat of kiln exhaust and surface of lining was charred. Fan, however, is still in service.—Information from Du Pont's *Elastomers Notebook*.


Adjustable Feed Pressure
Automatic Water and Air for Pusher and Drilling Mechanism. Extra-Strong Blowing
Feed Pressure Release and Retraction of Leg

THE ATLAS COPCO LION— A REVOLUTIONARY NEW ROCK DRILL

All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full and easy control without having to move the hand from the backhead!* All the controls have been designed so that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically. When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. *All this can be done while the drill is still running.*

This new idea of a retractable leg enables quicker repositioning of the leg and reduces the number of steel changes, thereby increasing footage per manshift. When drilling high holes it is now far easier to alter the position of the leg more frequently in order to maintain an optimal feed angle and feed pressure.

Packed with power for deep holes

The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it can maintain its high speed *even when drilling deep holes.* This means quickly drilled deep hole rounds and a faster advance. The Lion also reduces *to a minimum* the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a *handier* drill to work with in fissured rock.

Sandvik Coromant—the steel for the Lion

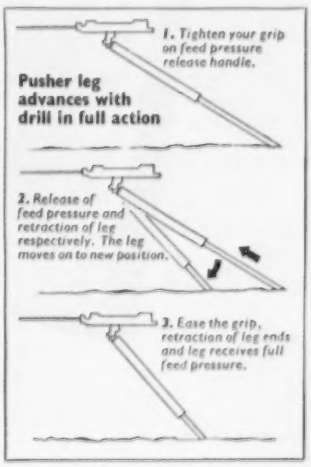
All Atlas Copco drills—and this goes for the Lion too—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. This combination pioneered tungsten carbide drilling in the early forties. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. Today it is the most widely used in the world, responsible for drilling more than 1,000 million feet annually.

For further information on the Atlas Copco Lion rock drill, and details of sales and service, please contact:

U.S.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, or Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA—Atlas Copco Canada Limited, Montreal Airport, P.Q.

MEXICO—Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.


1. Tighten your grip on feed pressure release handle.
Pusher leg advances with drill in full action
2. Release of feed pressure and retraction of leg respectively. The leg moves on to new position.
3. Ease the grip, retraction of leg ends and leg receives full feed pressure.

Atlas Copco

D1574A

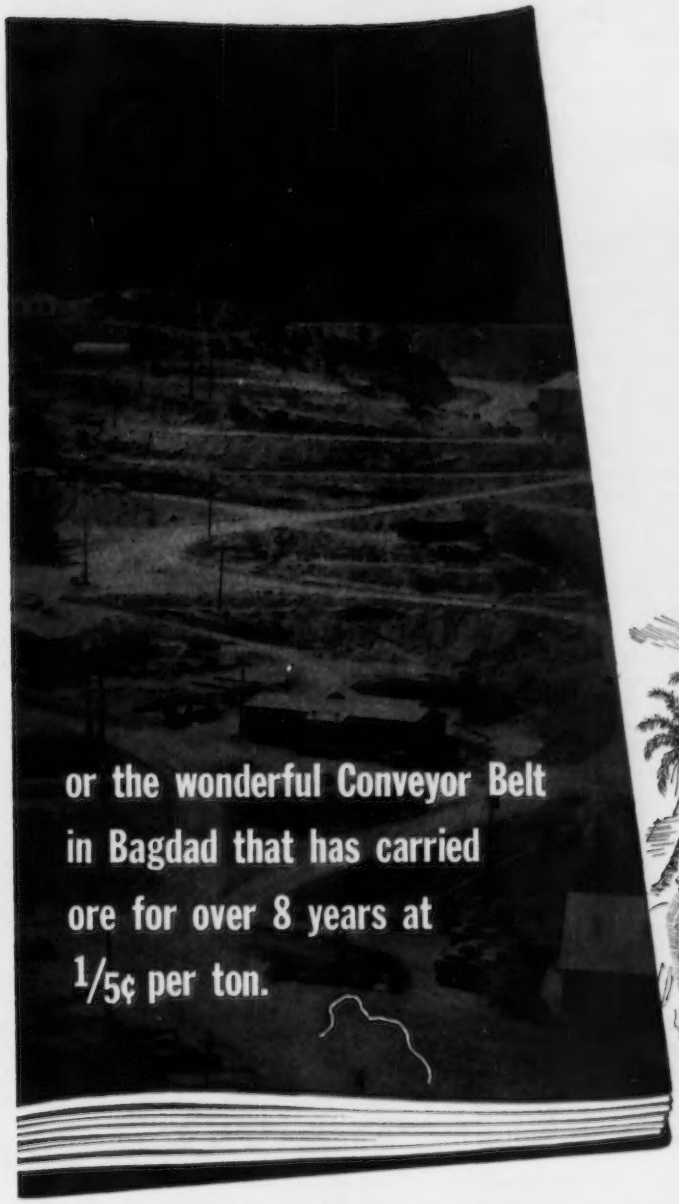
Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

US RUBBER CONVEYOR BELTS

Three Thousand and One Nights . . .

2000 ft. 36″ U. S. Matchless® belt with 6-ply Style YN cotton-nylon construction. Installed in the spring of 1949, it carries 6″ ore from primary to secondary crusher, up a 17½° grade. Note excellent condition and troughability, even after 8 years' service.

24″ U. S. Giant® belt, also installed in 1949, carries 3½″ ore up an 18° grade to the storage bins. It has handled more tonnage in less time—and with greater efficiency—than any previous conveyor belts.



Here in Bagdad—Bagdad, Arizona, that is—one of the leading primary copper companies extracts and processes sulphide copper ore at a highly efficient rate.

Helping to maintain this efficiency is the first patented "U. S." cotton-nylon conveyor belt ever put in a copper mill. Installed to carry 6" ore up a steep slope from the primary crusher to the secondary crusher, this U. S. Matchless belt began its operation early in 1949—three thousand and one nights ago.

Says the General Superintendent at Bagdad: "The belt has given excellent service, and we should get at least 2 or 3 more years of the same remarkable service from it."

Here's why Bagdad officials are so pleased with the belt:

- Belt has been on the job for 8 years.
- It operates 365 days a year.
- It has hauled over 10 million tons up a 17½° grade.
- Cost per ton is only 1/5 of a cent.
- The belt has required only minor maintenance.

For any materials handling problem, a complete line of conveyor belting—plus expert engineering assistance—is available at any of the 28 "U. S." District Sales Offices, at selected "U. S." distributors, or contact U. S. Rubber, Mechanical Goods Division, Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

Mechanical Goods Division

United States Rubber

WASHINGTON IMPACT

Highlights

BARTER REVIEW—When Agriculture Department belatedly announced its suspension of the surplus-crops-for-foreign-minerals barter program last month, it told only part of the troubles the program has run up against. Barter is in for a thorough combing-over, at least in Agriculture Department and possibly on Capitol Hill as well.

Bearing in mind that the program is primarily aimed at reducing surplus farm stocks, the Department's concern is clearly indicated in its statements. The big fear is that barter deals are taking care of foreign customers who might otherwise pay hard cash for U. S. crops, either to the Government as part of its cash sales disposal program, or to regular commercial exporters. Then, too, farmers are beginning to question how much of which grains should be offered for barter, and the State Department is getting bitter complaints from U. S. allies who also have crops to sell, and are yelling "foul" over what they call U. S. "dumping".

Nevertheless, the Administration is firmly committed to barter, and is expected to continue it as one practical means of getting rid of crop surpluses for some time to come, although at a probably reduced rate.

Some of the procedures under which barter works will be tightened, however, and it is these procedures which involve the metals and minerals industries. The White House has leaned toward barter as a keystone in its mining, as well as farm, policy—on the theory that it helps drain off world mineral surpluses, thus upholding world prices to the benefit of domestic producers. The drop in lead and zinc prices last month reflected at least in part the program's suspension, weeks before the move was officially announced.

Now, however, the White House isn't so sure. For one thing, the producers are split—some favoring barter, others claiming it artificially creates demand for foreign production, which in turn takes over some U. S. markets.

But what really has Washington worried, aside from farm and foreign policy considerations, is the way barter is reported to be working. Agriculture Department's Commodity Credit Corp., which handles barter contracts, deals with private commercial brokers on a subcontract basis. These contracts give a good deal of leeway, even within specified limitations. The broker, in those barter transactions dealing with most ores, has two years to repay CCC with metals for the crops he draws down.

Meanwhile, opponents of the barter program claim, the broker can multiply his normal 10% handling charge by speculating with foreign currencies he gets for the grain before he buys the metal or mineral to replace it. Also, this leeway may give him opportunity to take advantage of world commodity price fluctuations.

In lead and zinc barter, metals whose market price the Government wishes to sustain, CCC follows the opposite policy. Delivery must be made within two-and-a-half months. Government feels this provision reduces the possibility of encouraging world production increases. In this situation, the broker often receives agricultural products and obtains payment for the transactions after he has paid for the metals he supplies to the Government. Also, in this case the broker may have to pay an interest rate on funds used to obtain the lead and zinc rather than collect interest as in the case of other ores.

In barter, it is charged, the broker may even pick up domestic ore to replace the crops. This, says Agriculture Department, contravenes both the intent of Congress and the barter contracts themselves, but such practices have been reported, with serious economic implications, for two reasons:

First, the identity of an ore is hard to trace. (A finished product bartered for crops may be processed here, but the ore is supposed to be of foreign origin.)

Second, the legal authority for barter is unclear on this point—being derived from some seven different acts of Congress, including the CCC charter and several agricultural acts, only the latest of which (1956) contains the foreign origin requirement.

(See p 73 for latest reversal on barter)

Senate Okays $30-Million Mineral Purchase Bill

MINING-STATE SENATORS refuse to give up in their battle to salvage at least some of the previously-authorized money for Government purchases of tungsten, asbestos, fluorspar and columbium-tantalum.

The Senate agreed late last month to tack on the most recent in a string of supplemental appropriations bills, the $30-million scheduled for the first half of calendar 1957.

(The purchase funds for these items, approved last summer as a stopgap measure until Interior Department came up with its long-range mining policy "doctrine", fall into three piles: The $21-million already spent, the $30-million scheduled for buys through the end of fiscal 1957 this month, and the $40-million for fiscal 1958, ending next June 30. The House disallowed both the $30-million and the $40-million, which are currently tied up in joint Senate-House conference committees.)

The time period in which the $30-million was proposed to be used has expired. If Senate conference committee members can win agreement from the House, however, the $30-million will be used over the next 18 months, the duration authorized by PL733 last summer. This is possible, the Controller General has ruled, even though the present fiscal year expires June 30.

His ruling states that the authorization last summer takes precedence over the fiscal year expiration date. If House agrees to all or part of the remaining $30-million, the $40-million request will be dropped entirely.

Meanwhile, most of the Congressional opposition to the funds has centered around the 75-80% earmarked for purchase of tungsten. The Senate Interior committee is polling tungsten users to try to find out how much of the metal they plan to use in the future. If the estimates indicate less than the amounts cited by producers as an argument for the defense needs for tungsten, Senate conferees may agree to drop tungsten from the list to be bought with the $30-million, or cut it back substantially.

The House is expected to continue its opposition to the mineral money. However, the sponsors hope that conferees more amenable to the program will be appointed by House Speaker Sam Rayburn. But Rep. Michael J. Kirwan (D-Ohio), who fought previous purchase funds in conference, will still be on the battle line.

Late Developments

NO NEW APPLICATIONS for tax writeoffs on production facilities and equipment will be approved by the Office of Defense

unless they are asked for strictly military or Atomic Energy Commission work. This is the net effect of an unofficial administration policy decision in Washington last month.

Most of the so-called expansion goals for items on which suppliers could ask rapid tax amortization have been closed. Only three will remain open—military and AEC procurement needs, research and development facilities, and liquid oxygen and nitrogen—if ODM has its way.

•

FUTURE OF GOVERNMENT PURCHASES of lead and zinc hasn't been chopped off yet, despite indefinite Government pronouncements and industry fears that the stockpiling of these items is near the end of its rope. Shortly after announcing that buys of these two metals would continue "for awhile," defense mobilizer Gordon Gray reported that June stockpile calls, while remaining classified, would be "somewhat larger" than previous calls in recent months.

Gray admitted two seeming contradictions: First that the Government upped its purchase quotas because of the lower prices resulting from industry fears that Government buying would be cut off, and second that the ODM action would probably firm lead and zinc prices back up again.

•

CONTINUING ITS POLICY of trying to stimulate both domestic and foreign production of strategic metals, Office of Defense Mobilization has approved a new program of incentive purchases of foreign mica, "to supplement its domestic purchase program." The new incentive plan, announced by General Services Administration last month, calls for 5-years, instead of 2- and 3-year contracts with foreign suppliers, mainly Brazilian and Indian.

•

ANOTHER CRITICISM of the current nickel shortage has been unleashed in the form of a report by the Senate Armed Services Preparedness Subcommittee. Citing the history of Government programs and electroplaters' shortages and high prices, the report blamed increasing though unforeseen military demands and a failure on the part of the Administration to take corrective steps.

Defense mobilizer Gordon Gray answered the criticisms in the report by pointing out that it was prepared before new incentive purchase contracts were approved by ODM for GSA.

GSA is negotiating, Gray said, at the present for a large incentive purchase contract with International Nickel Co., presumably for Manitoba ores and concentrates.

Labor This Month

UNION RACKET REVELATIONS STING LABOR: Not just the Teamsters union is hurting from racketeering evidence uncovered on Capitol Hill. Details of financial dealings by the truck union president, Dave Beck and other officers of the 1.5-million member union are hitting across-the-board in organized labor's camp. Apart from the consequences of stalled legislative and organizing programs, the Senate racketeering hearings are reaching into the internal workings of unions that have nothing to do with the investigations.

Take Mine, Mill and Smelter Workers. With its share of troubles from the Federal investigations into alleged MMSW Communist leanings—both in the courts and the Subversive Activities Control Board—the mine union isn't anxious to take on any more. But, the Teamsters' revelations are hitting even here. Mine Mill leaders concede their program for higher dues and higher salaries for MMSW officers have been hit by the Beck probe. The dues increase—from $1.25 to $1.75 a month is the most important from the union standpoint even though the total ranks far below other rates, such as the United Steelworkers $5 a month.

LABOR LEADERS WIN PAY BOOSTS: Mine-Mill officials are probably the lowest paid in the labor movement. The president, John Clark, has been working for an annual salary of $6,750; the increase would boost this to $8,100. This compares with such top union salaries as the $50,000 a year paid to United Mine Workers' Chief John L. Lewis and Steelworkers president David J. McDonald. On down the line are AFL-CIO president George Meany at $35,000; and United Auto Workers president Walter Reuther, at $22,500. Reuther was the latest to rack up a pay increase at the UAW's recent convention which wanted to give him a bigger raise from his previous $18,000 rate. Reuther refused.

Mine-Mill's leadership proposal for boosting the wages of international representatives to $100 a week about matches the UAW's going rate for that office. However the auto union convention recently upped other salaries, including executive board members, to $12,500—a $2,500 hike, and the secretary-treasurer from $14,000 to $18,000. Dave Beck, whose troubles before the Senate racket investigating committee put a new emphasis on union financial matters, has a $50,000 annual salary, with a matching expense account.

ENGINEERS REJECT INDUSTRIAL UNION WOOING: In what may shape up as a sign of the future, engineers at Minneapolis-Honeywell turned down an appeal by the United Auto Workers for a tie-up with production workers for some hard bargaining with the company. The first key test after the UAW's publicized plan to organize engineers and other skilled workers was a big rebuff to UAW, and possibly to the white collar organizing campaign of industrial unions. Engineers at Minneapolis-Honeywell not only voted against UAW, they also rejected an independent union of engineers that had previously represented them.

The no-union vote has sent UAW statisticians back to the drawing board. They had confidently predicted victory after the UAW convention had voted special bargaining representation to skilled workers in the union. The Minneapolis-Honeywell group was to become the nucleus for the new white collar operations of the UAW. But, instead, the auto union lost out. Now, there's a lot of replanning to do.

Reason for the emphasis on white collar workers is that this group is fast becoming the dominant labor force. Already outnumbering production workers, white collar employes will continue the advance in numbers. This represents the industrial union's biggest target—but in test number one they missed, by a wide margin. Union officials didn't anticipate a sudden mass move by white collar employes to industrial unions. But the UAW thought it had a selling point in granting special bargaining authority to skilled workers divisions, with power to veto an over-all contract settlement pattern for all UAW members. However, this didn't do the trick, and re-affirmed the tough job ahead for Reuther and associates.

WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Exploration

Method and apparatus for rapidly and accurately determining the vertical component of gravity at any desired point in the vicinity of a geological anomaly of known dimensions and intensity. J. W. Northrup and G. A. Schurman, assigned to California Research Corp. No. 2,787,-417.

Mining

Design for a stopper or horizontal drilling mechanism of the single power cylinder type, for use where it is especially desirable that the apparatus be compact yet have a relatively long feed. Maximum feed of the drilling motor is materially greater than that of the feed cylinder. J. E. Fencht and H. W. Hauch, assigned to Cleveland Rock Drill Div., Westinghouse Air Brake Co. No. 2,787,-250.

Cone, or roller type, bit provides construction that permits the cones, bearing pins, anti-friction bearing races, and anti-friction bearings to be replaced in the field. Also, bearings can be effectively pressure-lubricated, and abrasive material removed from the bearings and races. E. J. Huckshold, assigned to Central Mine Equipment Co. No. 2,787,502.

Novel tamping stick and guide means for tamping dynamite into overhead drill holes makes provision for elevating and guiding the stick of dynamite into the hole. Tamping stick is so constructed that there is no danger of sparking during its use. I. D. Westen. No. 2,787,933.

Design for a highly flexible, single-motor jointed conveyor adaptable to many mining and quarrying applications. Apparatus will effectively pick rock off the floor and load it into a transport unit. J. D. Russell, assigned to Joy Mfg. Co. No. 2,788,144.

Design for an improved drill-steel centralizer for hammer rock drills. L. Lea, Jr. No. 2,789,789.

Adapter unit to be used in the conversion of a rock drill having a manually operable blower valve to one of the automatic blower valve type. W. C. Hilligoss, assigned one-third to W. F. Berner. No. 2,790,423.

Front dump skip for lifting muck from the bottom of a mine shaft. Provision is made for guiding the contents of the skip bucket across the space to the muck bin with a minimum droppage of muck back down the shaft. D. C. Leonard, assigned to E. Long Ltd. No. 2,790,569.

Improved rock drill packing sleeve is designed to prevent leakage of flushing medium from the flushing channel between the shank and the machine. B. E. R. Lofgrist and B. Berggren, assigned to Sandvikens Aktiebolag. No. 2,790,624.

Mr. North is a patent consultant, Washington, D.C.

Ore Dressing

Process for beneficiating low-grade iron ores, especially the Mesabi Range low-iron, clay-bearing, non-magnetic oxide ores known as "paint rock." Ore is crushed to 2 in. mixed with a solid carbon fuel, pelletized and indurated. F. D. De Vaney, assigned to Pickands Mather & Co. No. 2,789,894.

Hydrometallurgy

Process for recovering potassium chloride from low-slime sylvinite ore. Crushed ore is dissolved in heated unsaturated brine, and the slurry filtered. Cooling of the clear filtrate brings about precipitation of crystals of potassium chloride. J. B. Duke, assigned to Minerals & Chemicals Corp. of America. No. 2,788,-257.

• Copies of U. S. Patents can be purchased at 25¢ each from Commissioner of Patents, Washington 25, D. C.

Pyrometallurgy

A process for producing iron with a relatively high manganese content from ores or other materials of manganese and silicon-containing iron, while avoiding loss of both manganese and silicon from the charge. R. Doat, K. Heimberg and M. Paschke, assigned to Compagnie Generale de Conduites d' Eau. No. 2,787,535.

Vertical shaft furnace adaptable to the sintering of ores is so constructed as to produce uniform burning of material across the entire cross-section of the kiln. Also, excessive deterioration of firebrick lining at gas inlet points is eliminated. H. Pooley and L. D. Parker, assigned to Vickers Armstrong Ltd. No. 2,788,961.

Design for a small shaft furnace which will efficiently produce pig iron and alloys from low-quality, fine-grained iron ores and by use of fuels of relatively low quality. Furnace is of particular value for installation in small or undeveloped countries, or areas where limited output is desirable or necessary. O. Schnyder. No. 2,788,964.

Fluidized-bed apparatus and method for roasting pyrites, pyrrhotite or similar ores or materials, especially fine flotation concentrates, to produce sulfur dioxide gas plus a cinder product that is low in residual sulfur and of considerably larger particle size then the feed material. J. W. Swaine and J. C. Sloan, Jr., assigned to Allied Chemical & Dye Corp. No. 2,789,034.

Apparatus and method for rapidly reducing a bed of oxide ore or material to the metallic form. An excess of a reducing gas is passed through the bed at sufficient velocity to minimize the formation of reaction products at the exit surface. P. E. Cavanagh, assigned to Ontario Research Foundation. No. 2,790,-719.

Process for selectively chlorinating beryl ore. Mixture of carbon and pulverized low-beryllium ore is pelletized, and the pellets are treated with chlorine gas at a temperature lower than required for sintering, until the weight ratio of chlorine to beryl is between 1.6 and 2 to 1. Volatile chlorides of beryl, silicon and aluminum are then separately collected. W. W. Beaver, assigned to U. S. AEC. No. 2,789,880.

Means for preventing gas leakage between the moving pallets of a continuous sintering machine used for treating metallic ores and concentrates. A. A. Grabau and C. Herre, assigned to Arthur G. McKee & Co. No. 2,789,809.

Agglomerating iron ores and iron ore concentrates. Great bulk of the sintering machine charge is in the form of pellets, and these are not mixed with unagglomerated ore, as is usually the case. P. D. Nora, Jr., assigned to Jones & Laughlin Steel Corp. No. 2,789,895.

A process for concentrating nickel and cobalt values from a matte containing sulphides of cobalt, nickel, copper, iron and lead. H. Kenworthy. No. 2,790,713.

Process for producing metallic iron or pig iron by reduction of an iron oxide, particularly iron ore, with carbon monoxide and hydrogen. F. B. Sellers and P. L. Paull, assigned to Texaco Development Corp. No. 2,790,711.

Process for recovering aluminum. Bauxite is heated with carbon to produce a gaseous-phase mixture of aluminum, aluminum oxide and carbon monoxide, which in contact with excess carbon produces aluminum carbide. Disassociation at suitable temperature and pressure vaporizes the aluminum. E. Grunert, assigned to Pechiney. No. 2,776,884.

An improved method of manufacturing high-purity titanium by reacting rutile, ilmenite and other titanium-bearing materials with calcium halide (CaCl) and an alkali metal (sodium). Product is cooled, washed with alcohol, then dilute acid and dried. T. P. Whaley, assigned to Ethyl Corp. No. 2,777,763.

Method of smelting together tin and zinc ores in a blast furnace and recovering both metals from vapor take-offs in the furnace. Coke, lime and quartzite are added to the tin-zinc charge. S. E. Woods, assigned to Metallurgical Development Co. No. 2,779,673.

ABCs Feeder, one of several ABCs units operating at Huron Portland Cement Co., Alpena, Mich.

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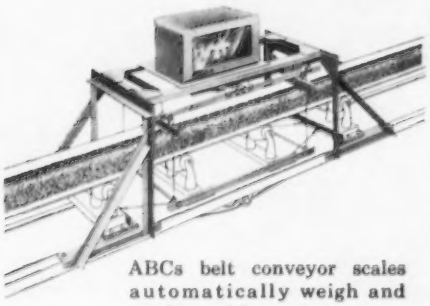

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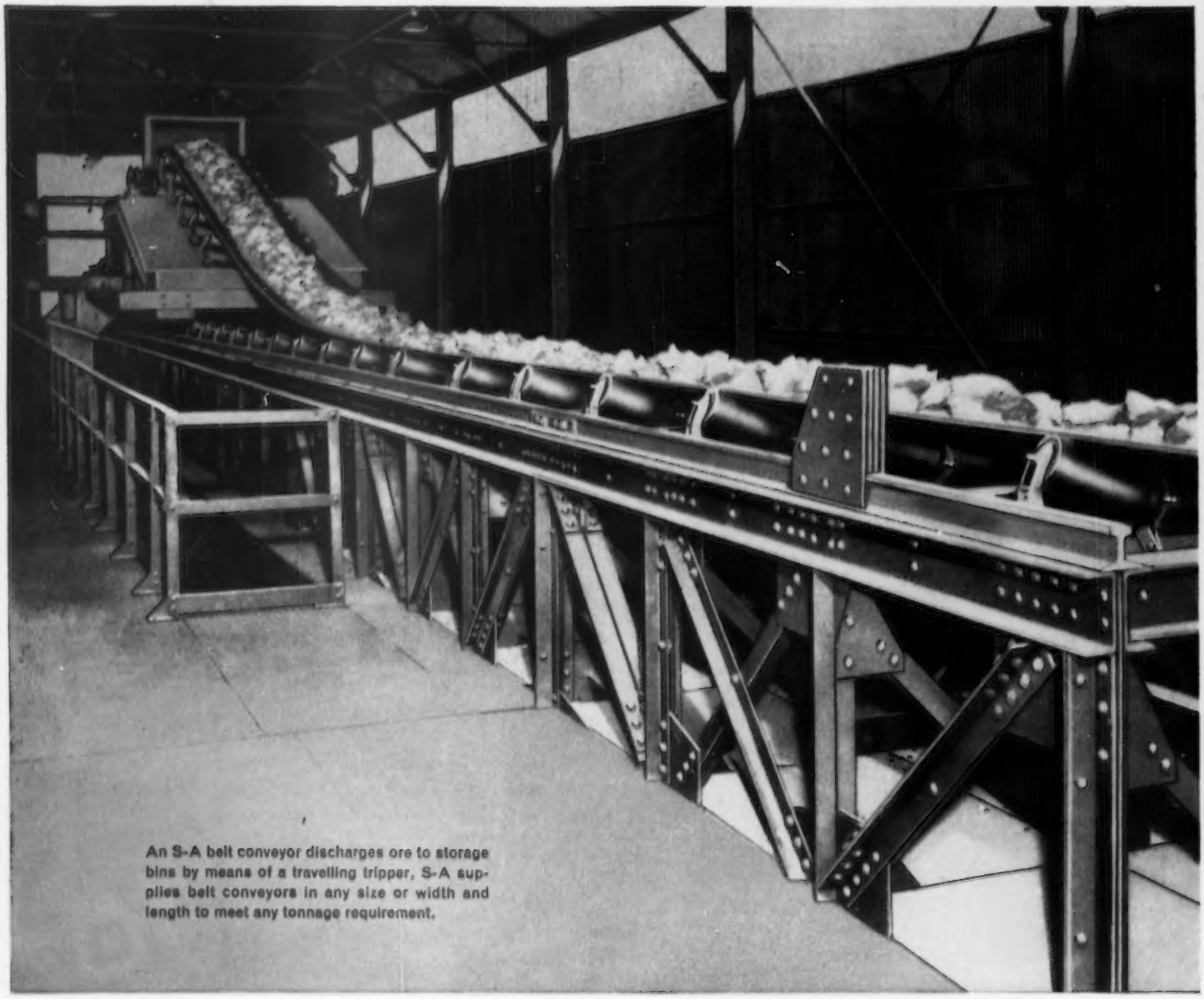
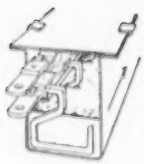


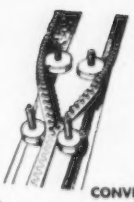
An S-A belt conveyor discharges ore to storage bins by means of a travelling tripper. S-A supplies belt conveyors in any size or width and length to meet any tonnage requirement.

BELT CONVEYORS

VIBRATING CONVEYORS



REDLER CONVEYORS, ELEVATORS



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PAN CONVEYORS

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BIN GATES—ALL KINDS

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that are engineered to the job!

With the entire mining field in the midst of world wide expansion, the technology required to mine and extract metals and minerals has expanded and developed more in the last decade than in the previous 45 years.

STEPHENS-ADAMSON engineering and conveyor equipment design have kept pace with this rapid development all the way. S-A systems reflect the advantages of more than fifty years experience by a company whose men are dedicated to constant improvement of bulk material handling methods and equipment.

S-A systems are planned for future increased tonnage demands. They are devised from the broadest range of manufactured products to more completely utilize manpower and save operating cost in every handling phase.

Plan now for the demands that increased tonnages will place on your ore handling system. Consult with the man who knows conveying best—the S-A sales engineer in your area.

Blue ground from a large stock pile is fed onto one of two main belt conveyors at a diamond mine location, Union of South Africa. Many million tons of ore have been processed by this system since its installation in 1950.

Primary crushed ore rides this 1200 ft. belt conveyor to a storage bin at a secondary crusher plant. Belt is 48" wide, rises a vertical distance of 190 ft. System includes a gravity discharge, dual drives, and hold back on head shaft.

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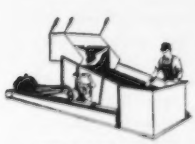
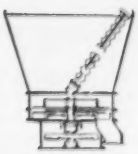
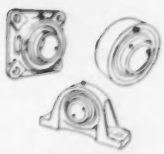


VIBRATING SCREENS



CIRCULAR BIN DISCHARGERS



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NEW BOOKS

Gmelins Handbook Series

Platinum, Part D, platinum complex compounds with neutral ligands. System 68 of the 8th edition of Gmelins Handbook of Inorganic Chemistry. Devoted to platinum complex compounds with neutral ligands, it completes Gmelin's platinum series, with part A and C. Literature cut-off point is 1953. In German. Published by Verlag Chemie, gmbh Weinheim Bergstr., West Germany. Available in U. S. through W. J. Johnson, Inc., 111 5th Ave., N. Y. 3, N. Y. and Stechert Hafner, Inc., 31 E. 10th St., N. Y. 3, N. Y. In German. 638 pp. Price $90.

Calcium, Part A, Section 2, occurences, the element, the alloys. System 28 of the 8th edition. Book completes part A on calcium. Industrial uses were dealt with section B1, published in 1956. Section B2 will be published at a later date. Published by Verlag Chemie, gmbh. Available as listed above. In German. 40 pp. Price $55.68.

Zinc, supplement volume. System 32 of the Gmelin Series, 8th edition. Covers: the element zinc, its compounds and alloys (to 1949); geochemistry of zinc; blende and its trace elements; metallurgy; ore dressing; reduction of the oxide; electrolytic zinc; and preparation of zinc salts. Published by Verlag Chemie, gmbh. Available as listed above. In German. 105 pp. Price $138.

Reports and Bulletins

Bulletin No. 39, Metal Resources of New Mexico and Their Economic Features Through 1954, by Eugene C. Anderson. Published by State Bureau of Mines and Mineral Resources, Socorro, N. M. Maps and 183 pp. Price $2.60,

Carte Geologique de Madagascar en treixe feuilles a l'echelle du 1/500,000, par Henri Besairie por Le Haut Commissariat de Madagascar et Dependences Service Geologique, Tananariva.

Carte Miniere et des Indices de Madagascar en treize feuilles a l'echelle du 1/500,000, par Henri Besairie. Same as above.

Volume LXIV, part 6, Geology of Lount Township, by J. Satterly. Published by Ontario Department of Mines and Technical Surveys, Toronto. Illustrated and maps in 43pp.

Preliminary Bibliography of Ross Dependency Geology and Supplement No. 1. Lists all references to the area. Antarctic Research Subcommittee, Geological Society of New Zealand, Wellington.

Geology of the Malindi Area, by A. O. Thompson for Geological Survey of Kenya, Nairobi. Illustrated and maps in 63 pp.

Volume LXIV, part 8, Geology of Dungannon and Mayo Townships, by D. F. Hewitt and W. Jones. Published by Ontario Department of Mines, Toronto. Maps and 61 pp.

Bulletin 173, Minerals of California, by Joseph Murdoch and Robert W. Webb. All mineral finds throughout the state in alphabetical order. Published by Division of Mines, Ferry Bldg., San Francisco 11, Calif. 452 pp.

Bulletin No. 21, Some Applications of Geophysical Methods to Geological Problems in the Gold Coast, by L. O. Gay and M. Kosten. Accra, Ghana. Maps and 37 pp.

Inventory of Washington Minerals, Part II, Vol. 1 and 2. Volume 1 is text in 398 pp. Volume 2 contains maps. Division of Mines & Geology, Department of Conservation & Development, Olympia, Washington. Both Volumes—price $4.50.

Tinplate Handbook, by W. E. Hoare. Available in French, Italian, German and English. 3rd revision. Published by Tin Research Institute, Fraser Rd., Perivale, Greenford, Middlesex, England. Also available from Tin Research Institute, 492 West 6th Ave., Columbus 1, Ohio or 43 Queen's Park, Toronto 5, Ontario. 43 pp. Free.

BOOKS PRESENTED on this page are available through the publishing house mentioned in connection with the individual literature. *E&MJ* does not sell or offer any literature presented here, unless specifically noted.

Bulletin No. 30, Geology of the Superficial Deposits and Coastal Sediments of British Guiana, by D. Bleackley. Published by Geological Survey of British Guiana, Demara. Maps and 46 pp. Price $3.

Bulletin No. 15, Geology of the Barberton Area, by D. J. L. Visser. Published by Department of Mines, Union of South Africa, Pretoria. Illustrated in 226 pp. Maps. Price £1 15s.

Bulletin No. 93, Experimentation With Large Hole Burn-Cut Drift Rounds, by J. J. Yancik, Jr. and G. B. Clark. Published by School of Mines & Metallurgy, Rolla, Mo. Illustrated in 90 pp.

Report No. 6A, Geological Map Coverage of Newfoundland, by D. M. Baird. Published by Department of Mines & Resources, Mines Branch, St. John's Newfoundland. Also includes—**Report No. 9, Geology of Oderin and Adjacent Island, Placentia Bay,** by D. H. Williamson. Maps and 34 pp.

Annual Report of the Geological Survey Department of Tanganyika, 1955. Published by the Society in Dodoma, Tanganyika. Price 3/.

MR 21, Rare or Less Common Metals in Canada, by T. H. James. Published by Department of Mines & Technical Surveys, Ottawa. 14 pp.

U. S. Geological Survey

• Professional Papers and Bulletins from U. S. Geological Survey, as listed below, may be obtained from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Remittance should be made by money order.

Professional Paper 80-A, Geology of Saipan Mariana Islands, Part I, by Preston E. Cloud, Jr., Robert G. Schmidt and Harold W. Burke. Maps and plates and 126 pp. Price unlisted.

Professional Paper 281, Geology of Central Cochise County, Arizona, by James Gilluly. Maps and 163 pp. Price unlisted.

Professional Paper 289, Geology and Ore Deposits of the Garfield Quadrangle, Colorado, by G. Dings and C. S. Robinson. Maps and 110 pp. Price $3.

Bulletin 1019-D, Bibliography of Iron Ore Resources of the World (to January 1955), by Gwendolyn W. Luttrell. 171 pp. Price 65c.

Bulletin 1024-F, Tungsten Deposits of the Hyder District, Alaska, by F. M. Byers, Jr. and C. L. Sainsbury. Maps and 17 pp. Price 70c.

Bulletin 1042-C, Geology of the Virginia City Quadrangle, Nevada, by George A. Thompson. Maps and 30 pp. 65c.

Bulletin 1042-D, Quicksilver Deposits Near Weiser, Washington County, Idaho, by Clyde P. Ross. Maps and illustrations in 24 pp. Price $1.25.

Motion Pictures

Standardization For the Long Haul, a documentary film by Barber-Greene. 16 mm film in sound and color. 30 min. May be obtained without charge by writing to W. E. Putz, Advertising Manager, Barber-Greene Co., 400 N. Highland Ave., Aurora, Ill.

How to Make a Motor Go—and Go and Go and Go and **How to Take Step Seven.** Two 20 min., 35 mm, color, sound slide films by Allis-Chalmers. Films cover maintenance and proper installation. Available from Allis-Chalmers Mfg. Co., Industrial Group, Milwaukee 1, Wis.

Make Mine Safety, a 16 mm sound and color film demonstrating the use of rock bolts in various mine applications, was produced with the cooperation of Anaconda Co., Climax Molybdenum Co., Intermountain Chemical Co. and U. S. Bureau of Mines. Available from Colorado Fuel and Iron Corp., Denver, Colo.

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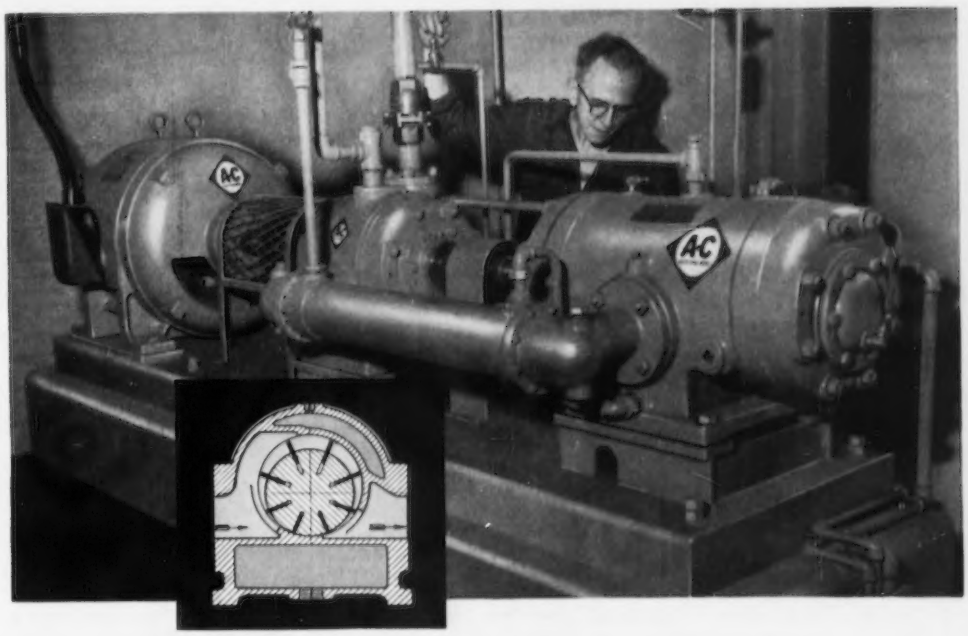
Compressors cut vibration . . . eliminate wear and tear



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ROTARY motion and fewer parts reduce maintenance costs to a minimum. Lack of vibration and shock, plus the absence of reciprocating parts — pistons, valves, connecting rods — eliminates major causes of trouble.

Other advantages are:

Constant efficiency — During operation the sliding vanes of the rotor press outward against the cylinder wall to form air cells (as shown in drawing). The rotating force holds vanes tightly against the cylinder wall under all conditions, and air cell size, air flow, and efficiency always remain constant.

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For Information — Call your nearby A-C office or write for Bulletin 16B8244 (two-stage) and 16B-8126 (single-stage). Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

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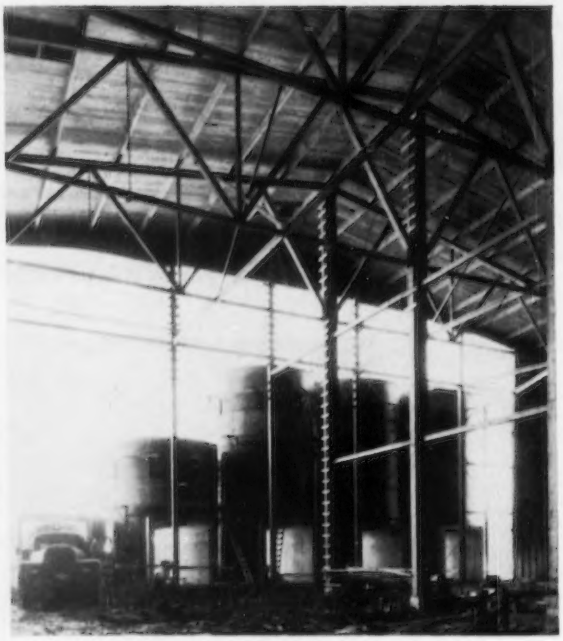
THIS MONTH IN MINING



STEEL ORE BINS at Newmont's Dawn mill are being readied for the opening of the facility next month. Each will store 350 tons of ore from Midnite Mine and other neighbors in the Spokane area. Mill will use sulphuric acid leach.

Spokane Uranium Area's Mill is Due in July

HAULING OF URANIUM ORE from the Midnite Mine on the Spokane Indian reservation to Dawn Mining Co.'s new 400-tpd mill at Ford, Wash., is scheduled to start this month.

The $3-million mill is to be completed in July and the ore will be stored at the plant yard stockpile area until it is finished. Dawn, a subsidiary of Newmont Mining Corp., has awarded the hauling contract to Beardmore Transfer Line, Inc., Spokane.

R. B. Fulton, Dawn Manager at Ford, said the plant operations area includes 10 buildings on a 200-acre site. The mill building is 300x140 ft. Prime contractor on the job is Western Knapp Engineering Co., San Francisco.

The mill circuit will utilize sulphuric acid leaching, counter-current decantation thickening and U_3O_8 recovery in ion-exchange columns. It is a process investigated and tested by the Bureau of Mines under Atomic Energy Commission sponsorship.

Dawn, which is operating Washington State's first uranium mine, this summer will start treating the ore at the Ford plant, which is the first uranium processing mill in the Pacific Northwest.

In addition to the Midnite Mine, the firm also is mining on the adjoining 458-acre Boyd leases on the reservation. No estimates of the ore reserves have been disclosed by Dawn or Newmont, but officials of Midnite Mines, Inc., which owns 49% of Dawn (Newmont owns 51%), have estimated the reserves at close to 700,000 tons.

The mill will handle custom ore from other companies in the Spokane area if it is found acceptable for treatment following amenability and analytical tests. Much of the outside ore is expected to come from the Mount Spokane district, where Daybreak Uranium, Inc., is operating several leases. Kae H. Sowers, Daybreak secretary-treasurer, said his firm has now stockpiled about 3,000 tons of ore at the Dahl lease on the mountain in anticipation of shipments to the Ford mill in the summer. The stockpile may be tripled in size by summer. Several other local firms have been active in development work, but none has started full scale mining with the exception of Daybreak and Dawn.

Dawn expects to push hauling operations during the spring, summer and fall months. Hauling will be suspended during the winter, when road conditions are poor in the reservation area. However, the mill will be run on a 24-hour-a-day basis throughout the year.

Laminated wood beams and plywood paneling covered with sheet metal are the basic materials in the mill building construction. Outside the structure are five 350-ton ore bins which will be filled from the stockpile area.

Process at the mill will involve grinding of uramium ore, dissolving it in sulphuric acid, thickening the resulting pulp and running the solution through ion exchange beds of strong base ammonium resins. When the resin has absorbed its capacity of uranium, it is washed and the uranium removed by chemicals which restore the resin for reuse. The plant will use from 500 to 600 tons of acid monthly.

Power (load at the plant is figured at 1200 kw,) will be furnished by Washington Water Power Co., which has constructed a new 60,000v substation to serve the mill and surrounding residential area.

The mill and related operations is expected to employ about 100. Dawn signed a contract with the AEC covering the mill last August, and construction was started in September.

H. S. Peterson, job superintendent for Western Knapp, said the project is more than half completed and about half of the equipment has been installed. Near the main building of the mill is a crusher plant. Also included in the project is a tailings pond covering about 50 acres. It has 10-ft banks.

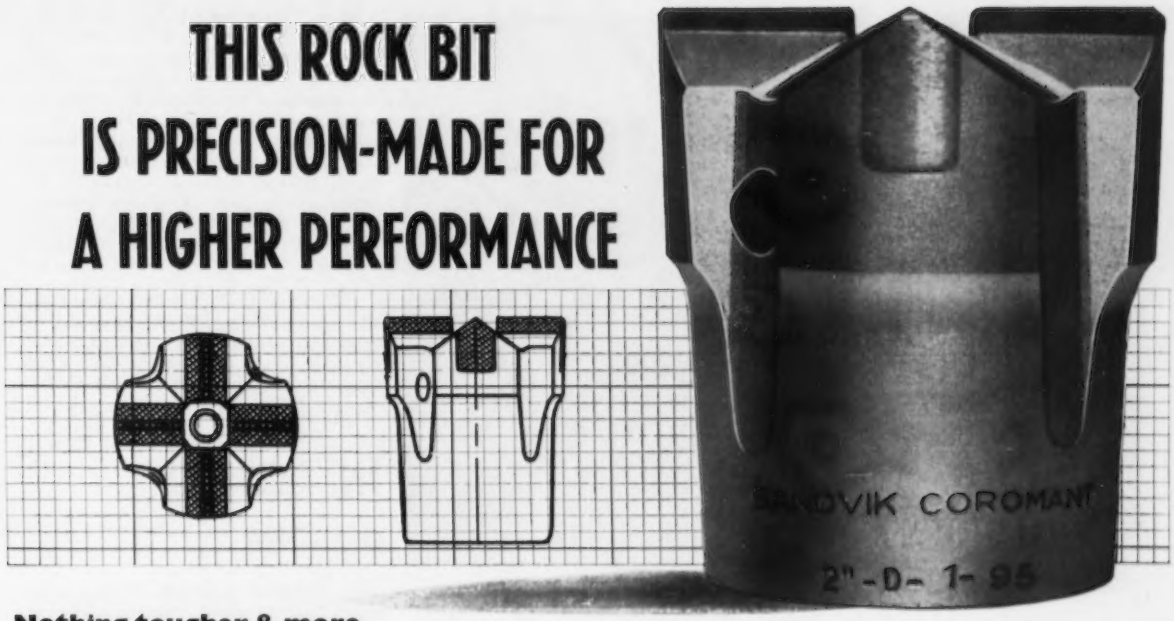
Large stockpiles of ore have been built up on the reservation, and Beardmore's hauling operation is expected to bring about 160,000 tons a year to the mill from the Midnite Mine and adjacent properties.

Asbestos Corp. Modernizes

ASBESTOS CORP. LTD. plans to close down two of its mines at Thetford Mines, Quebec, for one year while a modernization program is being carried out.

The King and Beaver mines, situated near Thetford Mines, 80 miles south of Quebec City, will be closed in June and reopened in July 1958. Approximately 310 men now are employed in the two mines, and 210 of them will be retained to help with the renovation.

THIS ROCK BIT IS PRECISION-MADE FOR A HIGHER PERFORMANCE



Nothing tougher & more wear-resistant than the insert of a Sandvik Coromant 776 bit

Rock bits that go on *and on* must have highest-grade tungsten-carbide inserts. Nothing but tungsten carbide in its purest state is good enough, will last as long. That's why the carbide that goes into a Sandvik Coromant 776 bit is meticulously controlled.

Sandvik, the world's largest manufacturers of brazed-in tungsten-carbide inserts for rock drilling, control every phase of production. Coromant carbide is scrutinized for impurities from the very first stages of processing the tungsten ore, right through to the final inserts. Add to that Sandvik's special process of securing the insert to the body, employing an exceptionally strong bonding metal, and you know why a Coromant 776 bit lasts longer. In 1955, more than 1,000 million feet were drilled with these inserts, all fitted to Sandvik Coromant bits or integral steels. *Nothing is more conclusive of the quality of Coromant bits.*

Nothing stands the strain like the Swedish body of a Sandvik Coromant bit

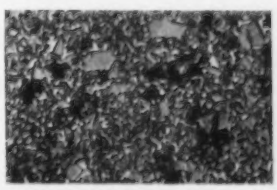
When you put the strongest possible tungsten carbide into a rock bit, the body has to be the strongest available to take the extra strain. That's why Coromant bodies are made of high-quality Swedish alloy steel. But that's not all. Inserts and clearance are cylindrically-ground and the insert ends precision-tooled to exactly the same height. This means *smoother* drilling and *smoother* holes, because the load is equally distributed on all four inserts. *Precision* engineering such as this gives Coromant bits a longer life!

Nothing fits like the precision-milled threads of a Sandvik Coromant bit

In order to get a smooth profile of the highest accuracy, Coromant threads are precision-milled in a special thread-milling machine and not made with a tap. Precision-milling too protects the skirt from common fatigue failures.

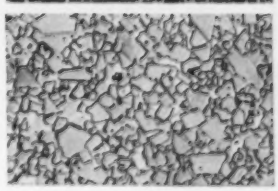
Low Quality Tungsten Carbide

These are unretouched, 1200-times enlarged microphotos. Above, carbide full of impurities. Those black marks are contaminations which are present when production and quality control are deficient. Contamination of this kind weakens the carbide and reduces its working life.



Sandvik Coromant Tungsten Carbide

This is Coromant carbide. Notice the uniformity of size and the even distribution of grain. Coromant inserts are free of dangerous porosity and impurities—the reason they go further, have greater strength.



Sandvik Coromant 776 bits

and Sandvik Coromant integral steels are available in standard sizes through Atlas Copco, who, in their own field, are the world's largest manufacturers of rock drills.

For further information please contact:

U.S.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA—Atlas Copco Canada Limited, Montreal Airport, P.Q.

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Atlas Copco *Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment.*

BINGHAM'S CEMENTATION launders handle more than dump washings.

Kennecott Gets an Assist from Spring Thaw

CEMENTATION, used at the Bingham Pit of Kennecott Copper Corp. to reclaim copper from the mill dumps, is also taking copper from a unique source. For years, the company has introduced water at the top of the dumps and run it over the shredded tin cans of the cementation launders. About 15-million lb copper is recovered annually.

The "gravy," which makes the recovery total so impressive, is not all from the dumps. Snow and the Oquirrh Range make a major contribution. It seems that when the winter snows atop the mountains near the huge pit begin to melt, they bring down a greenish-blue surface water. Kennecott traps it at the bottom of the canyon and diverts it through the cementation launders, too. The end product is 75 to 90% Cu.

Mining Advisory Group Cites Industry Ills

MEMBERS of the Western Governors Mining Advisory Council meeting in Reno on April 24 and 25 listed seven outstanding causes contributing to the present plight of the domestic mining industry. They were as follows:

(1) Increased costs of labor, supply, transportation and utilities without compensating increases in price.

(2) Government loans, grants and floor price contracts granted to foreign producers on the erroneous basis of "have not" appraisal of domestic mineral productive potentialities.

(3) Drastic reduction of the effectiveness of rates of duties on imported minerals and metals.

(4) Failure to gain needed relief from harm caused in negotiated trade agreements under the escape clause, peril point, and national security provisions of the Trade Agreements Act.

(5) A tax structure unfavorable to investment of venture capital in the long range activities of mineral exploration and development, and research, resulting in an inadequate testing of domestic mineral potentialities and a loss in ultimate tax revenues.

(6) Threats of rights of location and patenting of mineral rights under existing statutes and excessively high withdrawals of public domain for questionable need.

(7) Prolonged extension of the stockpiling program and recent introduction of the "barter" program in lieu of basic import controls, as the primary basis for aid of the domestic mining industry.

The report of the Council was made to the governors of the 11 western states who convened in Reno on April 25. The meeting was attended also by Felix Wormser, Assistant Secretary of the Interior, who defended the "barter" program in opposition to the Advisory Council's recommendation.

Chairman of the Advisory Council was S. H. Williston, of California, and Secretary was Louis Gordon, of Nevada. On the opening day, committees were appointed to study the individual problems assigned the Council and to make a report, which was acted upon by the Council as a whole. The committees and their chairmen were as follows:

Land and Water—Charles Willis, of Arizona; Mining Economics—Tom Lyon of California; Antimony — James R. Bradley, of California; Asbestos—Frank Knight, of California; Chrome—Hollis Dole, of Oregon; Coal—Lyman Fearn, of Wyoming; Cobalt—E. B. Douglas, of Idaho; Columbium, Tantalum—Robert Porter, Idaho; Copper—J. B. Pullen, of Arizona; Fluorspar—F. A. McGonigle, of Nevada; Gold—L. I. Huelsdonk, of California; Silver—Tom Lyon, of Idaho; Lead and Zinc—Miles Romney, of Utah; Manganese—F. A. McGonigle; Mercury —Gordon I. Gould, of California; Phosphate—Lloyd Haight, of Idaho; Potash —A. J. Thompson, of New Mexico; Rare Earth—Harold Bailey, of California; Tin —Phil Holdsworth, of Alaska; Thorium —Robert Porter; Tungsten—Roy Hardy, of Nevada; Uranium—Merritt Ruddock, of Utah.

Co-chairmen were Philip Bradley for Land and Water; J. R. Holman, of California, for Chrome; Robert Porter for Rare Earth; and Mitch Melich, of Utah, for Uranium and Vanadium.

IN THE U. S.

ARIZONA

Utah Southern Oil Co. reports shipments from properties in the Cameron uranium district ran at rate of 700 tons monthly during 1956.

The independent Salt Lake oil firm has scheduled a production rate of 1,000 tons monthly from the properties in 1957, according to George T. Hansen, president. He informed shareholders that uranium for first time was making a contribution to earnings of the company.

Shipments are made to Rare Metals Corp. of America mill at Tuba City.

Industrial Uranium, a privately-held corporation, has reported net profits of $234,198 for initial 11 months of operations.

Headed by Robert Schubach, Salt Lake optical concern executive, Industrial in a bootstrap operation has brought in more than 531,300 tons of high grade uranium ore on a Navajo tract a few miles south of the Utah line in Monument Valley, Ariz.

Properties are estimated to be worth $18,563,360. During the 11-month period, shipments of 19,142 tons of dry ore were made to mills with a settlement of $627,240.

The Navajos got $86,010 of this and the firm spent $135,607 in mining costs and more than $83,600 in exploration and development.

In its first report to less than 40 shareholders, the company said that "present operations are scheduled to complete production from the properties by March 1962. This will require a monthly average output of 8,000 to 10,000 tons of ore. We hope to achieve this rate by late 1957.

"As milling capacity of the buyer of our ore may be a limitation to this rate of production, we are contemplating advisability of combining with other producers having large reserves in acquiring or constructing a mill."

The firm has four separate mines with five ore deposits at present.

They were discovered solely by drilling and as a result of the geological work of Robert G. Harding, Bountiful, Utah.

40-R and 50-R Drills Prove Superior In Taconite and Other Hard Ore Bodies

Bucyrus-Erie rotaries are offering welcome relief to the problem of steadily mounting production costs. Applied in taconite and a variety of other extremely hard formations, they soon increase the rate of penetration so greatly that one Bucyrus-Erie rotary is able to replace several cable tool rigs.

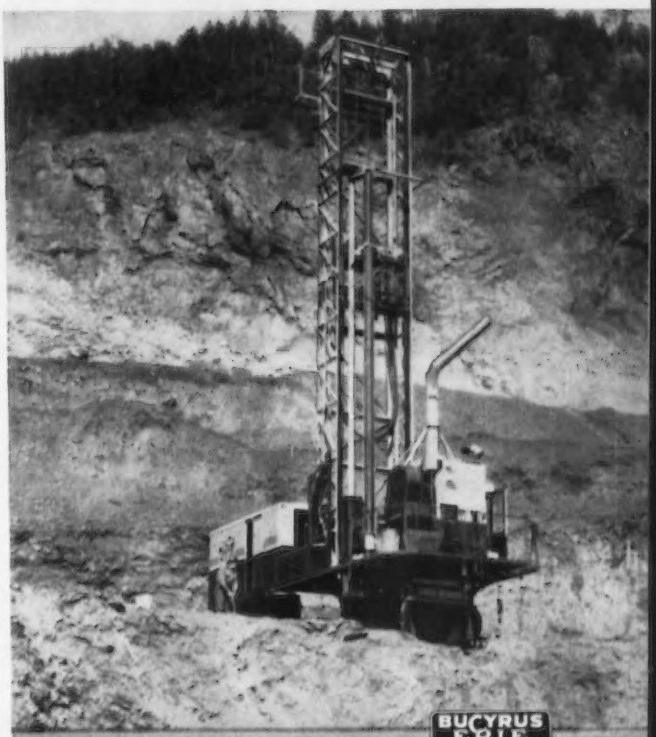
Using compressed air to cool the bit and to clean the hole of cuttings, the 40-R and 50-R offer several advantages. By removing the need for water—a problem during cold weather—they eliminate auxiliary equipment, cut maintenance and labor costs. Heavy cuttings pile up adjacent to the drill, providing handy, excellent stemming material. Dry sampling of the hole can be accomplished easily and more accurately.

These and other features provide the fine performance that promises even greater economies in the future. Two rotaries are available—the 40-R for drilling 6¾- to 9-in. holes, the 50-R for drilling 9⅞- to 12¼-in. holes. Get all the facts on these drills today.

54B57C

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin



AT STEEP ROCK LAKE—Cost records for this 40-R, working 140 miles west of Port Arthur in Ontario's Rainy River district, show that the machine cut drilling costs per foot of hole by more than 50 per cent. The 40-R drilled 9-in. holes to the same average depth drilled previously by cable tool rigs.

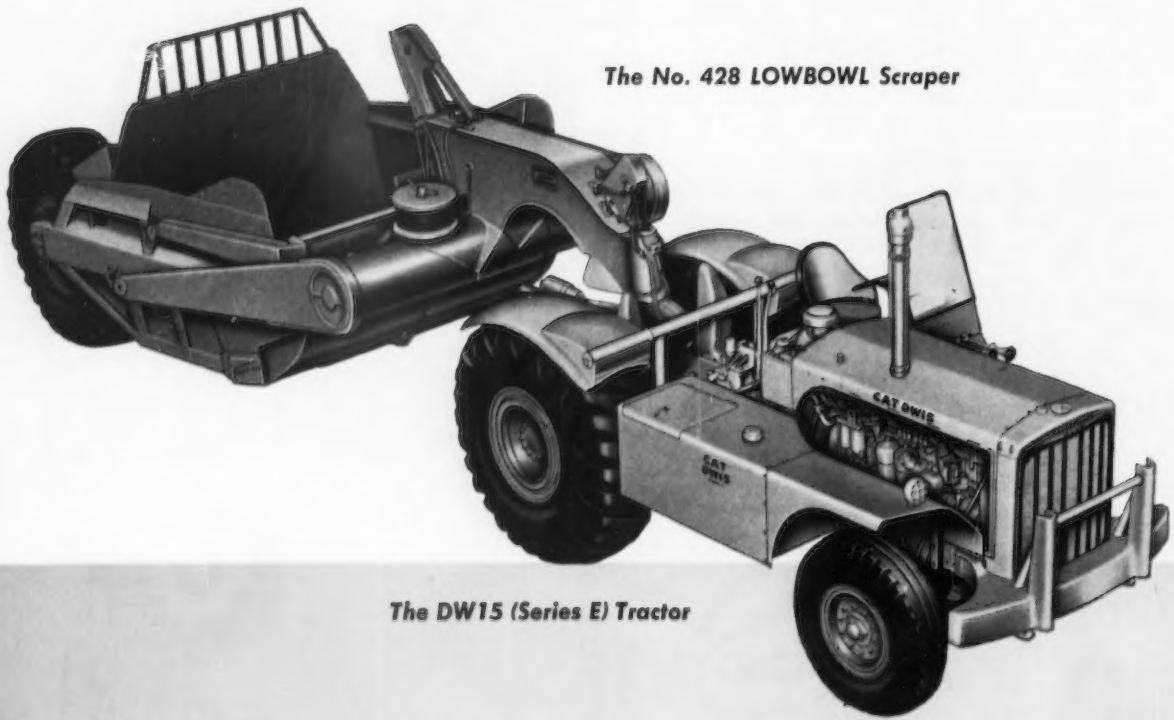
AT A WESTERN IRON MINE—Some of the toughest rock drilled by a 50-R was encountered here. On this assignment the 50-R shown here drilling 9⅞-in. holes, put down over three times as much footage per shift as each of the four cable tool drills it replaced.

ON THE MESABI RANGE—Bucyrus-Erie 50-R rotaries are now drilling blast holes through taconite formations. A 50-R at one mine reduced costs as much as 34 per cent, and achieved a rate of peneration four times as great as the penetration rate of standard cable tool rigs.

IN LABRADOR—Drilling both 9-in. and 9⅞-in. holes, this Bucyrus-Erie 50-R was used to put down hole through material consisting of up to 63% iron and 2½% to 12% silica, with overburden made up of non-formation and dolomites. The overall performance of this 50-R was so favorable that the company later ordered five more.

CATERPILLAR ANNOUNCES

NEW DW15 (SERIES E) AND NEW No. 428 LOWBOWL SCRAPER



The No. 428 LOWBOWL Scraper

The DW15 (Series E) Tractor

Here's a new Cat team loaded with features that add up to one thing—A HIGHER PRODUCTION RETURN ON YOUR INVESTMENT. See your Caterpillar Dealer for details on this great team's performance.

GET THE STORY IN BRIEF ON THE OPPOSITE PAGE ▶

A GREAT TEAM: The performance of the DW15 (Series E) Tractor and No. 428 Scraper can be summed up simply: bigger loads—faster.

FACTS ABOUT THE DW15 (SERIES E) TRACTOR

Around the world, the DW15 has proved that it can move material faster and more profitably than competitive machines in its class. Now there's a new DW15 (Series E) to give you even higher production. This is the story:

ENGINE: A new Caterpillar D326 Engine, designed especially for the DW15 (Series E), develops 200 HP (maximum output capacity).

And Caterpillar research has produced a 23% torque rise in this new engine! This means that high tractor rimpull is maintained through a wide range of travel speeds in each gear, and the need for gear changing is decreased. In fourth gear, for example, over 3,000 pounds of rimpull are delivered at travel speeds from 9 MPH all the way to 18 MPH. A new engine, yes—but with these traditional Caterpillar advantages: uses inexpensive No. 2 furnace oil without fouling; needs no fuel system adjustments; requires no cleaning of fuel injection valves.

TRAVEL SPEED: The DW15 (Series E) offers ten speed selections, from 2.7 to 37.2 MPH. But, more important, it provides four-wheeled sure-footedness—*the ability to use the speed on the job.* Operators ride with more comfort, feel greater stability. They travel faster, and in safety.

MANEUVERABILITY: Four-wheeled stability means faster cycle time because the DW15 (Series E) can make short radius turns at higher speeds. It can turn without stopping inside a 35-foot diameter and in a smaller area through use of a turn-back-turn maneuver.

VERSATILITY: The DW15 (Series E) provides versatility that far surpasses similar sized two-wheeled machines. It can be unhitched from its scraper and used as an independent unit to tow compactors, water wagons or other units, and it can be teamed with the Athey PR15 Wagon for rock hauling work.

FACTS ABOUT THE No. 428 LOWBOWL SCRAPER

CAPACITY: Struck—13 cu. yd.; heaped—18 cu. yd.

ADVANCED DESIGN: There is more to Caterpillar's exclusive LOWBOWL design than a low bowl profile. Width and length proportions are designed to give maximum loading efficiency. And every component—particularly the apron, ejector, cutting edge—is likewise designed to do its part in achieving capacity loads.

LOADABILITY: The final result of this careful engineering is this: bigger loads—faster. LOWBOWL design gives the new Caterpillar No. 428 Scraper a faster loading rate because incoming material meets less material resistance and less friction from the load already in the bowl. While other scrapers are still in the cut struggling for the last few yards of their load, the new Cat units are on their way to the fill—with big pay loads!

NEW FEATURES: Outstanding new features of the No. 428 include: increased ground clearance—for high-speed travel in rough going; increased apron lift—for faster ejection of any material; large area pushblock—for better pusher contact.

NEW TIRES FOR THE DW15-No. 428

Both the CAT* DW15 (Series E) Tractor and No. 428 Scraper feature 26.5-25 wide-section tubeless tires—the product of extensive co-operative research by Caterpillar Tractor Co. and leading tire manufacturers. Tubeless tires offer load-carrying capacity comparable to conventional tires at a *reduced inflation pressure.* This gives better flotation and traction while decreasing rolling resistance. The wider tire treads take a "grouser like" bite, making more efficient use of engine horsepower. And tubeless tires eliminate 80% of the down time caused by tire failure.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.

You'll save with lightweight Bemis FLEXIPIPE®

For your ventilating job, specify **Bemis Nyprene FLEXIPIPE,** the "featherweight" flexible tubing that is also amazingly tough and durable and is not affected by acids.

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All three grades of FLEXIPIPE available with Bemis Rope Seam Suspension *at no extra cost.* No horizontal wires, vertical collars, hooks or other gimmicks.

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Arizona *(Continued)*

mining geologist who is vice president in charge of operations.

CALIFORNIA

Kaiser Steel Corp. is planning improvements for its Eagle Mountain Mine in southern California that will boost production 40%.

Additions will be made to the iron ore beneficiation plant and crushing and screening facilities, and the mine's railroad system will be expanded. New mining equipment will be purchased, and 80 additional men will be hired.

The changes are part of an $81-million program the company has undertaken to boost its ingot capacity to 3-million a year, which will make Kaiser the largest steel producer in the West.

The $81-million is in addition to a $113-million expansion program already under way. The two programs will double the company's ingot capacity.

Kaiser's blast furnaces at Fontana, which use iron ore, coal and limestone from company-owned deposits in the West, will be able to turn out 2,121,000 tons of pig iron a year when the changes are completed.

Plans also are under way to boost production at Kaiser coal mines in Sunnyside, Utah, and Raton, N.M.

United States Borax and Chemical Corp. has started digging into the orebody of the company's borate deposit at Boron. Tincal ore, the principal raw material for a host of important boron chemicals, was reached at a depth of 137 feet.

A total of over 7-million tons of overburden has been removed since the pit was started in early 1956. Development of the open pit was started in early 1956 and marks the end of underground extraction of ore from the company's deposit. This deposit is the largest known sodium borate orebody in the world.

Construction of new plant facilities at Boron to process ore from the open pit is proceeding on schedule and production is slated to begin in early June.

A high-grade deposit containing scheelite crystals has been encountered at Tyler Creek tungsten mine in Tulare County, according to the state division of mines.

The crystals, a form of scheelite rarely found in California, occur in a body of tactite 18 ft wide, 60 ft high and 100 ft long. The matrix in which they are found is phlogopite, a magnesium mica, the division said.

Crews are driving an adit—now more than 300 ft long— and cutting raises to block out the orebody. Working face of the adit is in soft granodiorite.

The mill is working around the clock, processing at the rate of 100 tpd. National Tungsten Corp., operator of the property, plans to make improvements in the mill—mainly in the classification equipment. Recovery of WO_3 is about 75%.

The mine, located at California Hot Springs, had produced about 1,000 units of WO_3 by 1955, when NTC acquired it. Reserves, including ore blocked out and in stockpile, are now set at 18,000 to 22,000 tons, the division said.

The Taylor group, headed by Reese H. Taylor, Jr., Los Angeles, has begun additional exploratory drilling on Coso Uranium, Inc.'s claims in the Coso Range, Inyo County. In the past few months the group financed the drilling of some 30 holes on the 460-acre property by Colorado Exploration Co.

W. O. Merritt, president of Coso Uranium, Inc., reported 10 most westerly holes located ore deposits of 20 to 45 ft thickness in un-recemented sedimentary lake bed material at 45 to 70 ft. Average content of U_3O_8 was reported at .055%. Company says coreholes blocked out some 800,000 tons of ore.

Preliminary geological studies are under way on an additional 127 claims, covering 2,500 acres, which Coso holds in the adjacent Cactus Flat area.

Mill buildings and equipment at the historic Big Blue mine near Kernville, Kern County, have been sold for $15,600 to Anderson Brothers Corp., Albuquerque, N.M., by Sacramento district office of the Corps of Engineers. Mine is located in the Isabella Dam reservoir area. Removal operations are scheduled to be completed by August.

Borate mineral colemanite was found in a exploratory hole drilled about four miles northeast of Kramer, San Bernardino County, by U.S. Geological Survey. Core hole on Sec. 18-11n-6w went to 2,568 ft, finding colemanite in cores from 1,455 to 1,555 ft. One 20-ft section averaged 7% B_2O_3. Drilling is part of a program to add to known reserves of borates.

COLORADO

Idarado Mining Co.'s operation in the San Juan area continued its steady pace with a record 480,000 tons of base metal ore production in 1956. The expansion of the Pandora mill near Telluride was completed and has attained a productive level of 40,000 tons of ore monthly. During the past year both Telluride Mines, Inc. and Tomboy Gold Mines, Inc. were liquidated into the parent Idarado Mining Co., an affiliate of Newmont Mining Corp. thus creating the largest consolidation of mining properties in the history of the district, totaling over 5,000 acres of continuous patented claims.

Construction is underway on the Metallurgy Building on the Colorado School of Mines campus. The new building, which will cost a little over $1-million, including equipment, will cover more ground than any other building on the campus. It will contain more than 60,000 square feet of floor space, approximately the same as the new chemistry building, Coolbaugh Hall.

Gold Coin Mining & Leasing Co. in addition to the Cashier Mine at Montezuma has acquired the Bard Creek mine near Empire and started a crew of men

ON THE go

by J. Hall Carpenter

PRODUCTION OF RARE EARTHS IN KOREA will be increased by Carpco high tension and magnetic equipment now enroute. Korea brings to eight the number of countries using Carpco equipment to separate monazite and other rare earth minerals.

THE CONCENTRATION OF SCHEELITE by use of high tension allows the removal of the sulphides by an inexpensive and simple process. No chemical addition or roasting is required and high recoveries are achieved. This process also leaves the sulphides as a salable product. We have available a technical report on this type of separation for those who desire it.

THE PRECISION SAMPLE SPLITTERS manufactured by Carpco in Jacksonville and Brisbane combine high quality material and workmanship with a unique design that offers unusual sampling accuracy. They are constructed of non-corrosive stainless steel and aluminum alloys, are rustproof and rugged in construction. The use of the top hopper with cut-off gate eliminates the need for a third sample pan and precludes the possible error normally caused by pouring out of a pan onto the riffles. Microsplitters are available, descriptive bulletin, SSB-103 is yours for the asking.

PRODUCTION OF MONAZITE FROM ALLUVIAL CONCENTRATES at the Marine Minerals plant in Aiken, South Carolina, is described in detail in a paper prepared with the cooperation of Robert Griffith and presented at the recent meeting of the AIME in New Orleans. Particular attention is paid to the problems of ore dressing when the monazite occurs in stream placer deposits. If you missed the meeting and would like a preprint of the paper, just say the word.

Carpco

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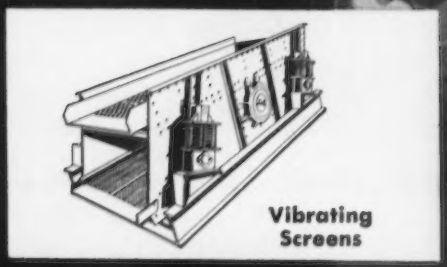
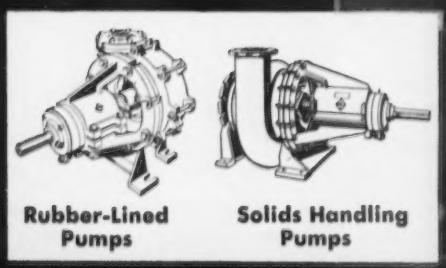


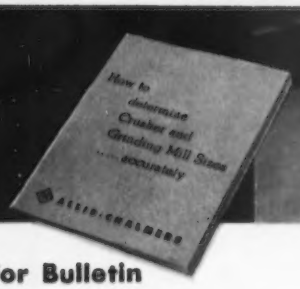
Vibrating Screens

Grinding Mills



Rubber-Lined Pumps

Solids Handling Pumps



Send for Bulletin 07R7995

"Work index" formula enables you to evaluate crushing and grinding operations . . . compare efficiency of plants, circuits, machines. This handy reference offers only scientific method of determining the right machine and required horsepower.

Gyratory Crushers

Emergency unloading, wear compensation, setting changer are flip-of-the-switch operations on Allis-Chalmers crushers equipped with *Hydroset* mechanism. Even the world's largest crusher utilizes the convenience and economy of the *Hydroset* mechanism.

Texrope Drives

For maximum efficiency in transmitting power between motor and machine, Allis-Chalmers offers a complete line of *Texrope* V-belt drive equipment . . . variable speed sheaves, fast adjusting motor bases, *Texrope* belts with 33% more gripping strength.

GET ALL THE FACTS. See your Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-

One Responsibility

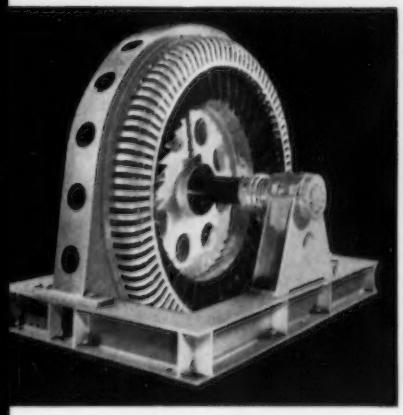
PROFIT PACKAGE

Processing Machinery, Pumps, Motors and Power Equipment Engineered to Work Together . . . Designed to HELP YOU Increase Production and Cut Costs

CRUSHERS, grinding mills, screens, pumps, generators, switchgear, transformers, motors, drives, control — *Allis-Chalmers builds them all.* And out of this unequalled diversity has come the unique ability to "coordineer" machinery and equipment for a complete process—yes, even for an entire plant.

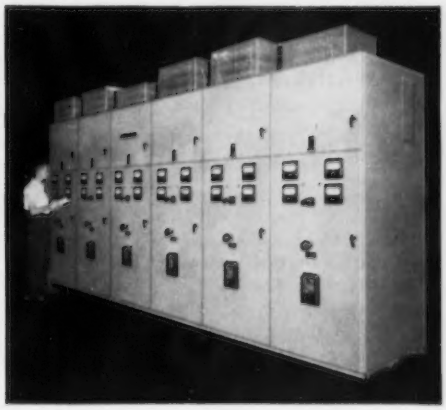
How it Works

Allis-Chalmers maintains separate departments staffed by research, design, manufacturing and application specialists for each product. "Coordineering" results from an interdepartmental exchange of ideas and technical information correlated in *one department specializing in mining applications.* In this department components are matched to meet the requirements of your job. New as well as existing equipment in your plant is integrated into a smooth, productive, profitable operation. And, of course, Allis-Chalmers assumes undivided responsibility for efficient performance.



Motors

Allis-Chalmers builds a complete line of motors from ½ horsepower and up. Applying the "work index" formula, Allis-Chalmers engineers can help you determine the required power input and apply the right size motor needed for maximum efficiency and economy.



Control

Starter illustrated features circuit designed to cut crusher downtime. Overload protection is provided by two sets of thermal overload relays. One set operates on slight overload to sound warning. Second set stops motor when temperature reaches the danger point.

Unit Substations

Designed for maximum flexibility. Additions or replacements to basic centralized unit can be made conveniently at any time. Strategically located, unit substations bring high voltages near load centers — cut cable costs, minimize line loss, save space, provide complete protection.

CHALMERS

A-C ALLIS-CHALMERS

Hydroset and Texrope are Allis-Chalmers trademarks.

A-5406

Are you getting the results you should from your fluid mixing operations?

Maybe you're wondering if a switch in your fluid mixing methods can give you process results that you're not quite getting now.

You're interested in boosting extraction values to a new level. You want to produce more uniform feed for a high-pressure chemical reduction. Or you'd like to tighten your control of crystal size.

And you suspect that the right *kind* of mixing could cut your operating costs substantially.

There's a good chance we can help you.

Predicting mixing results

Not long ago, some of our engineers showed a customer how to get highly uniform feed for his flotation cells—using only *half* the power input he'd been using.

Another customer asked us to figure out whether a *batch* or *continuous* mixed system would give him better extraction economies. We were able to predict his return from either system, giving him an accurate basis for making his choice.

What good mixing can do

We're convinced that mixing is a critical area in ore processing—and we'd like to convince you, to your profit.

We'd like to show you how good mixing can give you results you can measure—in terms of faster through-put, better extraction percentages, closer quality control, more product from fewer reactors.

We specialize in just one thing—*fluid mixing that does what you want it to do.*

No risk—here's why

We back it up, too. When you specify a LIGHTNIN Mixer, you're protected by an unconditional guarantee that the mixer will do the job for which it is recommended, or your money back.

You can get LIGHTNIN Mixers for any fluid mixing job, in tanks of any size and shape. The exact flow pattern that will give you optimum results is determined *scientifically,* with accurate prediction of results.

Your mixer is selected from hundreds of standard power-speed combinations, using data unique in industry and based on 30 years of research and field experience in fluid mixing.

You're served by a competent LIGHTNIN Mixer representative conveniently near you—and by prompt shipment of parts when you need them.

What to do now

If you'd like to know how modern fluid mixing can help give you the results *you're* looking for, just call in your LIGHTNIN representative. (He's listed in Thomas' Register.) Or write us for these helpful catalogs describing LIGHTNIN Mixers:

- ☐ Turbine, paddle, propeller types: top or bottom entering: 1 to 500 HP (B-102)
- ☐ Propeller types; top entering: ¼ to 3 HP (B-103)
- ☐ Portable: ⅛ to 3 HP (B-108)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Rotary mechanical seals for pressure and vacuum mixing (B-111)
- ☐ Side entering: 1 to 25 HP (B-104)

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 1234-f Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., Toronto 10, Ont.

Colorado *(Continued)*

working on the cleanup job. The company will specialize mostly on the mining of silver in addition to gold, lead and zinc. The Cashier is reported to have reserves of ore.

Minerals Productions Co. of San Francisco, Calif, has started to reopen the old Lily Mine, on Taylor Gulch, near Salida, according to president George N. Yeyston, Jr. "We have just started work," he said, "and are driving an incline shaft which is now down nearly 100 ft. We have showings of gold, silver, lead and copper, the silver-lead now being the most pronounced. And we have reasons for believing that we will find heavy copper mineralization with increased depth. Scott Lockland is superintending operations at the mine."

Merrill E. Shoup, president of Golden Cycle Corp. gives a review of some adverse conditions in the annual report for the year ended Dec. 31, 1956.

"Operating costs in the Cripple Creek Mining District, which produces only gold, continued to increase and because of increased wages and material costs and the fact we are compelled to sell all of our gold to our only purchaser, the Treasury of the United States at $35 an ounce, profits were less in 1956 than in 1955," says the report.

"Due to competition for lessees and miners from uranium and base metal mines, there is a labor shortage in the Cripple Creek District which curtailed production."

Shoup said the uranium division produced 11,546 tons of ore with a gross value of $397,960 last year. This compares with 6,840 tons worth $241,900 in 1955. "Every ton of gold ore taken out of the Cripple Creek district is gone forever, and to exist we must continually open new reserves. This is costly and, at this particular time, places an added burden on our finances," he said.

Construction of the Aspeco process pilot plant for retorting oil shale is now 75% completed. Plant will process 24 tpd of Colorado oil shale. It will provide the first big scale test of the Swedish Aspeco process.

Construction and erection of the machinery is done by the Stearns-Roger Manufacturing Co. Research leading to the pilot plant design has been by Denver Research Institute under contract with the Oil Shale Corp. of Beverly Hills, Calif. H. E. Linden, president. The project represents at least a $330,000 investment to date.

In the Aspeco process, heat is applied to the raw shale by passing it through a special ball mill in which the porcelain balls have been preheated in a separate chamber.

Twenty-six pound slab of native silver —80% silver and 20% copper—from the old Cashin mine on La Sal Creek south of Paradox Valley was exhibited in Grand Junction by James Collard, vice president and general manager of Von Gemmingen & Co., St. Louis. The St. Louis firm has been working the Cashin since last October, concentrating on cop-

STAYS ON THE JOB LONGER

Rugged body and frame withstand the impacts of loading, hauling and dumping heavy excavation in construction, mine and quarry service.

SPEED AND STABILITY

The 5-speed transmission and Euclid planetary axle provide top speeds with full payload up to 27 m.p.h. Free-floating Euclid spring suspension gives maximum stability empty or loaded under all road conditions . . . permits faster safe travel speeds.

18-ton payload with 16.00 x 25 tires

OUTSTANDING FEATURES OF THIS 18-TON "EUC" REAR-DUMP

- 36,000 lb. payload
- 10½ yd. body
- 218 h.p.
- 16.00 x 25 tires
- hydraulic booster steering
- air assist clutch

Here's the New R-18 "Euc"

that sets a new high in Rear-Dump Performance!

For over 20 years Rear-Dump "Eucs" have paced the field in mine, quarry and construction work. They have delivered "plus" performance year in and year out on hundreds of the toughest jobs.

This Model R-18 incorporates the engineering advances, easy operation and maintenance features resulting from unequalled field experience with other Euclids of the same capacity. Dependable work-ability means more payloads per day at lowest cost per ton or yard moved.

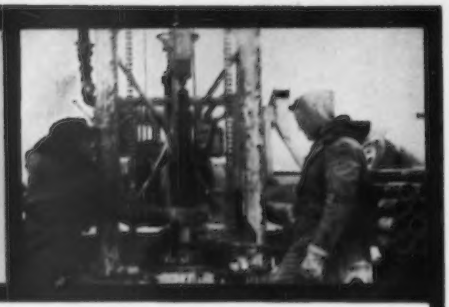
Have your Euclid dealer give you the full details on this new 18-ton Rear-Dump and the complete line of Euclid earth moving equipment. He'll be glad to show you why so many users have proved for themselves that ***Euclids are your best investment.***

EUCLID DIVISION, General Motors, Cleveland 17, Ohio

Euclid Equipment

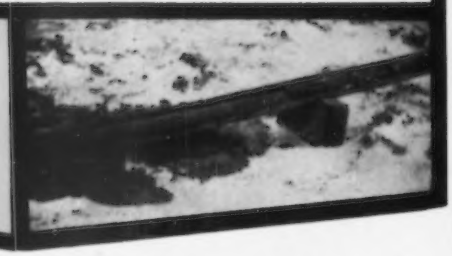
FOR MOVING EARTH, ROCK, COAL AND ORE

Cooperation between manufacturer and operator gives . . .

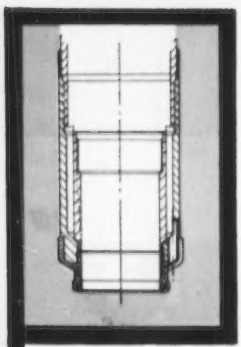


96.7% CORE RECOVERY

IN POORLY CONSOLIDATED FORMATIONS



Equipment Engineered for the Job



Core recovery in the Gas Hills of Southwestern Wyoming was only 40 to 60 percent, proving a major problem to drillers. This very low return was first attributed to the failure of core catching devices to hold core in the inner tube. After considerable trial and error with every type of core catching equipment the Christensen engineer became convinced that the circulation fluid was actually washing away the friable and poorly consolidated uranium bearing sediments before they entered the inner tube.

With all the facts and actual job experience, Christensen then adapted the 4½" x 3" core barrel for use with a long nose or pilot type diamond set core bit. This allowed the driller to actually core *ahead* of circulation.

The new barrel and bit design by Christensen, together with proper fluid and volume controls, gave impressive results.

1. Total coring has yielded 96.7% recovery.
2. *All* units of the formation have been cored successfully.
3. An average of 25 feet of core is obtained per drill shift.
4. Combined cost of diamond bit and core barrel, $2.31 per foot, considerably lower than previous averages.

Discuss your coring problems with the Christensen engineer. There is almost always an existing design for any situation, if not, Christensen can adapt one for your needs.

Do you have our catalog? Write for SD-506

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH 2nd WEST SALT LAKE CITY, UTAH

Colorado *(Continued)*

per, and found the rich silver pocket in a new heading.

The Cashin has been worked intermittently since the early 1890s.

Beaver Mesa Uranium, Inc., Grand Junction reports an improved financial position as a result of shipment of 24,582 tons of average grade 0.30% U_3O_8 ore from properties in the Gateway Mining district on the Utah-Colorado line. Allan Simpson, Beaver Mesa president, said the shipments for the six months ended Feb. 28 compared with output of 8,192 tons of ore averaging 0.40 in comparable 1955-56 term.

Simpson said that Beaver Mesa was activating the Rajah mine as a result of drifts extended from existing mining areas in the district.

The aim is to hike Rajah production to 1,000 tons of carnotite ore monthly.

He termed a negotiated reduction in royalty allowance on properties as an aid in earnings.

IDAHO

Highland-Surprise Consolidated Mining Co. has been granted a $16,005 contract by DMEA for preliminary exploration of its Copper Camp copper prospect in the Big Creek District of Valley County. The project calls for about 80 hours of bulldozing and some 1600 ft of diamond drilling to provide additional geological and assay data on the seven parallel vein outcrops which have been found on the property. If results of the initial work are sufficiently encouraging, DMEA has indicated that it will give favorable consideration to an application for additional exploration.

Sunshine Mining Co., which has assisted with preliminary engineering studies of the property, will be offered an opportunity to participate with Highland-Surprise in the venture on a profit-sharing basis.

Sunshine Mining Co. has started opening a new 4,000-ft level in the West Rambo area of the property of Silver Syndicate, Inc. A north crosscut from the new bottom level of the main Jewell shaft has been underway since early April and is expected to cut the Silver Syndicate fault-vein about 250 ft north of the shaft station. Previous mining on this high-grade silver-lead ore zone extended to the 3840-ft level.

Gold-bearing sands in the Coeur d'Alene District of Shoshone County will be the target for investigation this summer by field crews of the Idaho Bureau of Mines and Geology. Other field parties will go into the primitive areas of Lemhi County, to the Elk City area of Idaho County and to the Stanley Basin of Custer County to map and study deposits of thorium, uranium, columbium, tantalum and rare earths.

Central Farmers Fertilizer Co., Chicago cooperative headed by Joseph L. Lanter, has let a general contract for $7.5-million to Jacobson Construction Co. of

B.F.Goodrich

Universal tires still going strong after nine years' service at Illinois mine

MORGAN MINES, INC., operates 14 units at its Williamson County, Illinois, strip mine. Trucks operate year 'round, hauling 30-ton loads of coal over rock and gravel roads. When this mine opened in 1947, Morgan chose B. F. Goodrich tires—and, writes Superintendent Glenn Peugh, "Some of those original tires are still in service with only one retread! The Universal tread pulls better and gives us far less sideslip and skidding."

B. F. Goodrich builds Universal tires with husky, wedge-shaped cleats that grip the ground for positive traction in forward or reverse. Under the specially compounded tread is the B. F. Goodrich *all-nylon* cord body. Nylon is stronger than ordinary cord materials, withstands double the impact and resists heat blowouts and flex breaks. The B.F.Goodrich *all-nylon* cord body outwears even the extra-thick Universal tread, *can still be retreaded over and over.*

Why not follow the lead of Morgan Mines and other leading operators all over the country who have switched to B.F.Goodrich tires. Your nearby B.F.Goodrich dealer will show you the tires that will save you money. Or write *B.F.Goodrich Tire Company, A Division of The B.F.Goodrich Company, Akron 18, Ohio.*

MORGAN TRUCKS line up at mine tipple. 90% of the company's tires are B. F. Goodrich.

MORGAN SUPT. Glenn Peugh (left) says, "We are 100% satisfied with B. F. Goodrich tires."

Specify B.F.Goodrich tires when ordering new equipment

B.F.Goodrich
FIRST IN RUBBER

Your B. F. Goodrich dealer is listed under Tires in the Yellow Pages of your phone book

Idaho *(Continued)*

Salt Lake City, for construction of a phosphate rock processing and calcium metaphosphate manufacturing plant at Georgetown Canyon in Bear Lake County. Rock processing facilities are expected to be in operation by late 1957 and the metaphosphate plant is scheduled for completion in the fall of next year.

The Hull Lease, one of the Coeur d'Alene District's pioneer leasing operations which for many years has operated the Gem Mine and portions of American Smelting and Refining Co.'s Frisco Mine at Gem, has been forced by economic conditions to suspend operations permanently. Constantly rising costs and low metal prices have made it impossible to continue, officials said.

The lease, commonly known in the district as the "Haywire," had been active since 1917.

One of the biggest merger deals in the Coeur d'Alene District in recent years —a consolidation involving six mining companies and combining into a single unit properties covering almost the entire western extremity of the famous Silver Belt for eventual deep development by the Bunker Hill Co.—is currently being perfected. Involved in the merger proposal are Altura Mining Co., Hill Mining & Milling Co., Mohawk Silver-Lead Corp., Paramount Mines Corp., Yreka Mining Co., and Yreka United Inc.

Yreka United would be the surviving parent firm. The plan contemplates conclusion of an operating agreement with Bunker Hill under which Bunker Hill would undertake to finance and carry out deep exploration of the consolidated area from the 18,000-ft sea-level tunnel now being driven by the Bunker Hill firm to connect the 3200-ft level of its Crescent Mine on Big Creek with the 2300 level of the main Bunker Hill workings south of Kellogg. The agreement would provide for reimbursement of all Bunker Hill advances and subsequent division of any production that might result from the exploration between the contracting parties.

San Francisco Mining Co., Montpelier, Idaho, was sole bidder on 184 acres of phosphate lands 6 miles northeast of Randolph, Rich County, Utah, placed up for lease-purchase by the U.S. Bureau of Land Management.

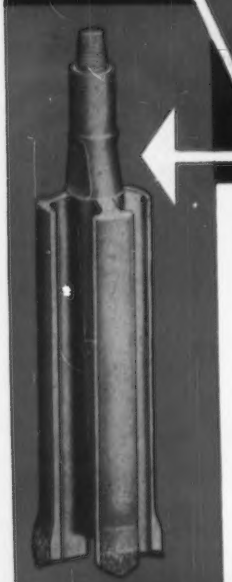
San Francisco bid 25c an acre the first year of lease, 50c the second and $1 an acre the third year. The extraction of phosphates are subject to royalty payment to the government.

Bunker Hill Co. has started underground exploration at the Bayhorse group of lead-silver properties in the vicinity of Challis, according to Roger McConnel, the firm's chief geologist.

The company took a purchase option on the claims last year and has conducted geological studies of the property. A tunnel is now being driven to test the claims, and this summer the firm plans additional tunneling and drilling.

DRILL LARGE DIAMETER HOLES THE MODERN WAY . . . WITH

SPANG FABRICATED STAR BITS



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SPANG FABRICATED STAR BITS replace the conventional, old-style spudding bit and the big hole paddle-type bit. They are made in large diameters for drilling hard formations, and can be dressed, ready for drilling, by hard surfacing quickly and economically, thereby saving the time consumed heating and ramming. Made in a variety of diameters, lengths and weights, with any size joint desired, SPANG Fabricated STAR BITS are your assurance of profitable **big hole** drilling.

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SPANG PILOT-TYPE REAMER BITS ARE RECOMMENDED

Field performance has amply proved these bits to be the driller's answer to **large hole** problems. They are made special, to your specifications and design, in any diameter; size and weight limited only by the handling capacity of conventional drilling rigs. They can be furnished to run on drilling stem or with integral rope socket top.

For detailed information on SPANG Fabricated STAR BITS and SPANG PILOT-TYPE REAMER BITS for big hole drilling, plus 52 page CATALOG, consult your nearest SPANG DEALER or write direct to

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For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Water Wells, Prospect Drilling and Shot Blast Holes.

MICHIGAN

Republic mine near Republic, its concentrating plant, a pelletizing plant at Eagle Mills and the Empire mine have been transferred to Marquette Iron Mining Co. In that company Cleveland-Cliffs owns 47½% of the stock, the remainder being held by Jones & Laughlin Steel Corp., Inland Steel Co., Wheeling Steel Corp. and International Harvester Co. Cleveland-Cliffs will be the operator. Production from the plant is expected this year.

As it enters its 73d year of activity, the Gogebic range is preparing for a busy season. Pickands, Mather & Co. is shipping from its Newport, Geneva, Paterson, Sunday Lake and Cary mines, extending from Hurley, Wis. on the west to Wakefield, Mich. on the east. Stockpile shipments will also be made from the Anvil-Palms from which the last ore was hoisted on Jan. 31, 1957. Oglebay, Norton Co. is shipping from its Montreal mine at Montreal, Wis. where the first preparatory work was done in 1886. The Montreal has shipped nearly 10.5-million tons during the last ten years. Pacific Isle Mining Co., which shipped 237,794 tons from the Wake-

MEDIUM IN SIZE . . . LARGE IN CAPACITY
A NEW CONTINUOUS-RATED SLUSHER FROM JOY

The C2F-211A is a *new* kind of slusher. It is the size of a medium capacity machine . . . compact and portable enough to move from place to place in the mine. Yet, it approaches large capacity slushers in load lugging ability and hour-after-hour stamina.

To meet extra-heavy digging requirements this newest Joy slusher is powered by a 50, 60, or 75 HP high-torque, high slip, flange-mounted motor. The high torque developed pulls the scraper through the pile without stalling. By eliminating repeated stalling and starting, fewer shock loads are imposed on the machine. Other features, such as *three* idler gears in each drum's planetary system provide 50% greater capacity.

Depending on motor horsepower and rope pull desired, rope speeds range from 165 to 350 feet per minute. Find out more about the C2F-211A, the new medium-sized slusher that hauls the bigger scraper loads. Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WSW M 6703-183

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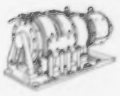
JOY **. . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY**

Core Drills


Slushers

Rock Bits

Trackless Equipment

Have you tried the new dipper teeth...

that are already saving money for all major mining companies on the Iron Range?

Facts about Wearpact® Steel

The best combination of hardness and toughness available anywhere

About 2½ years ago, a new alloy was developed with unusually high hardness—477 minimum Brinell—and yet was *tough*. Able to stand up, without flow or distortion, under the worst kind of abrasion and impact. Now used with excellent results on crusher liners, grousers, end bits, corner shoes and cutting edges.

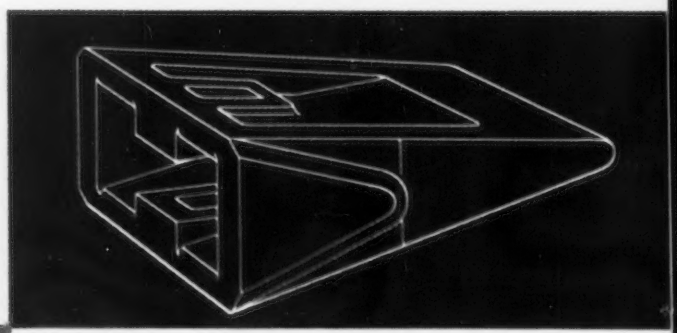
Today, for example, only 30 months later, every major mining company on the Iron Range is using Wearpact Steel teeth. And what a record these teeth have made! Reports from a taconite mine, where service conditions are worst of all, show that manganese teeth last an average of 3 shifts—with two repointings. But the same reports show that Wearpact Steel teeth average 12½ shifts—*straight through*. No more pulling teeth off the shovel after each shift; no more piles of teeth in the welding shops, each waiting for an expensive rebuilding job.

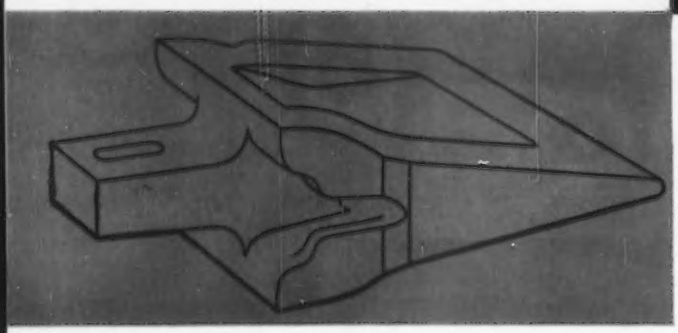
Hardness and toughness alone didn't account for all this increase in service life. The Wearpact teeth were of a different design . . . with long, sweeping cutting edges that stay sharp; *slice* rather than ram through the ore. No other commonly used alloys would permit designs like these; only Wearpact has the necessary tensile strength and high yield point. And remember; you don't work-harden Wearpact. It's hard—clear through—as shipped. Teeth are ready for tough service the minute they're installed. No hardfacing needed.

How much money can Wearpact Teeth save in YOUR mine?

That depends on your operating conditions, of course. Find out for yourself—with your own cost figures—that Wearpact can save money for you, as it has in other mines. Now is the time to arrange for a test of Wearpact. Write today for name of your nearest ASF Representative, or use the coupon below.

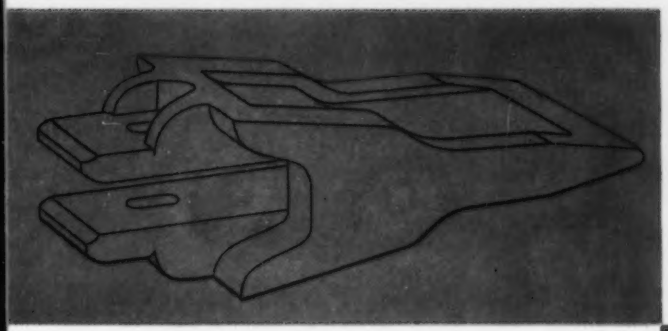
WEARPACT Style 3





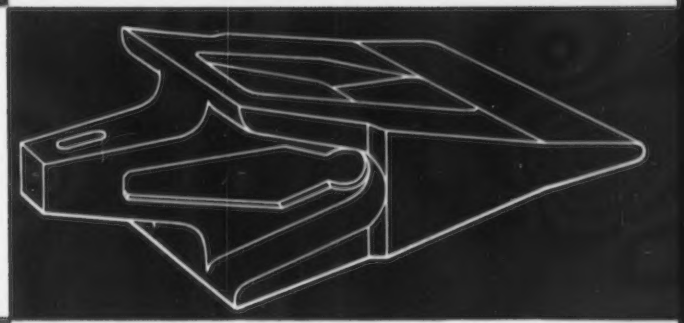
WEARPACT Style 1

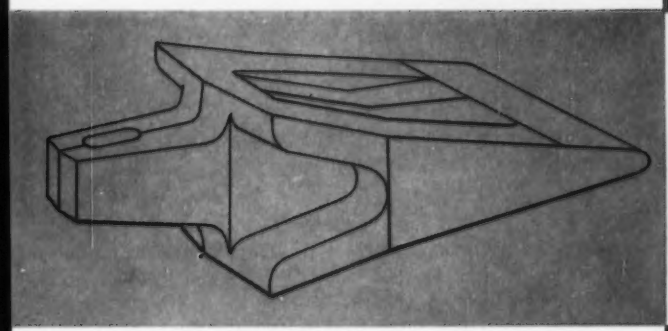
Typical Wearpact Steel teeth now used in leading mines



WEARPACT Style 5

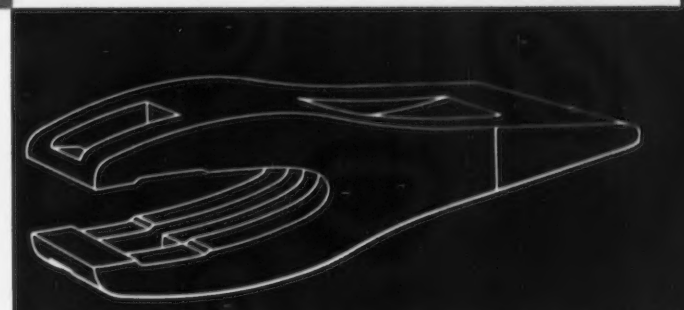
WEARPACT Style 7





WEARPACT Style 11

WEARPACT Combination Tooth and Base



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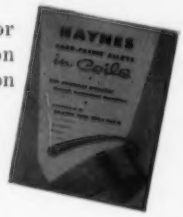
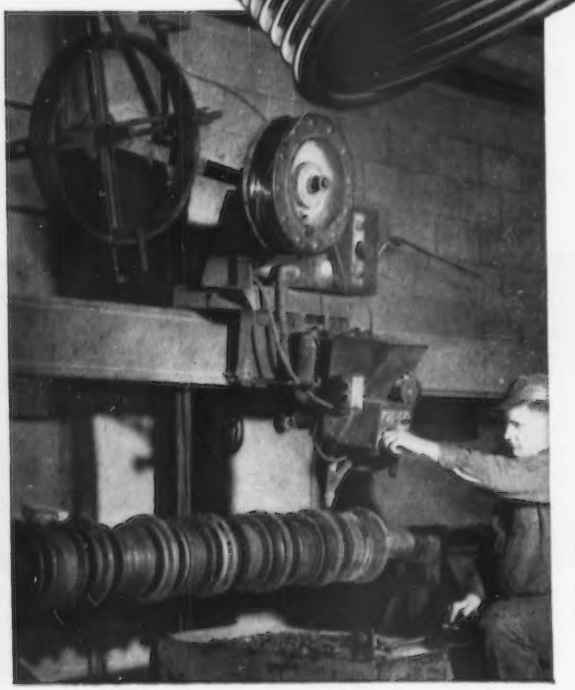
They are available in six alloys for superior protection against abrasion and impact. For complete information send for descriptive booklet. Write HAYNES STELLITE COMPANY, A Division of Union Carbide Corporation, Kokomo, Indiana.





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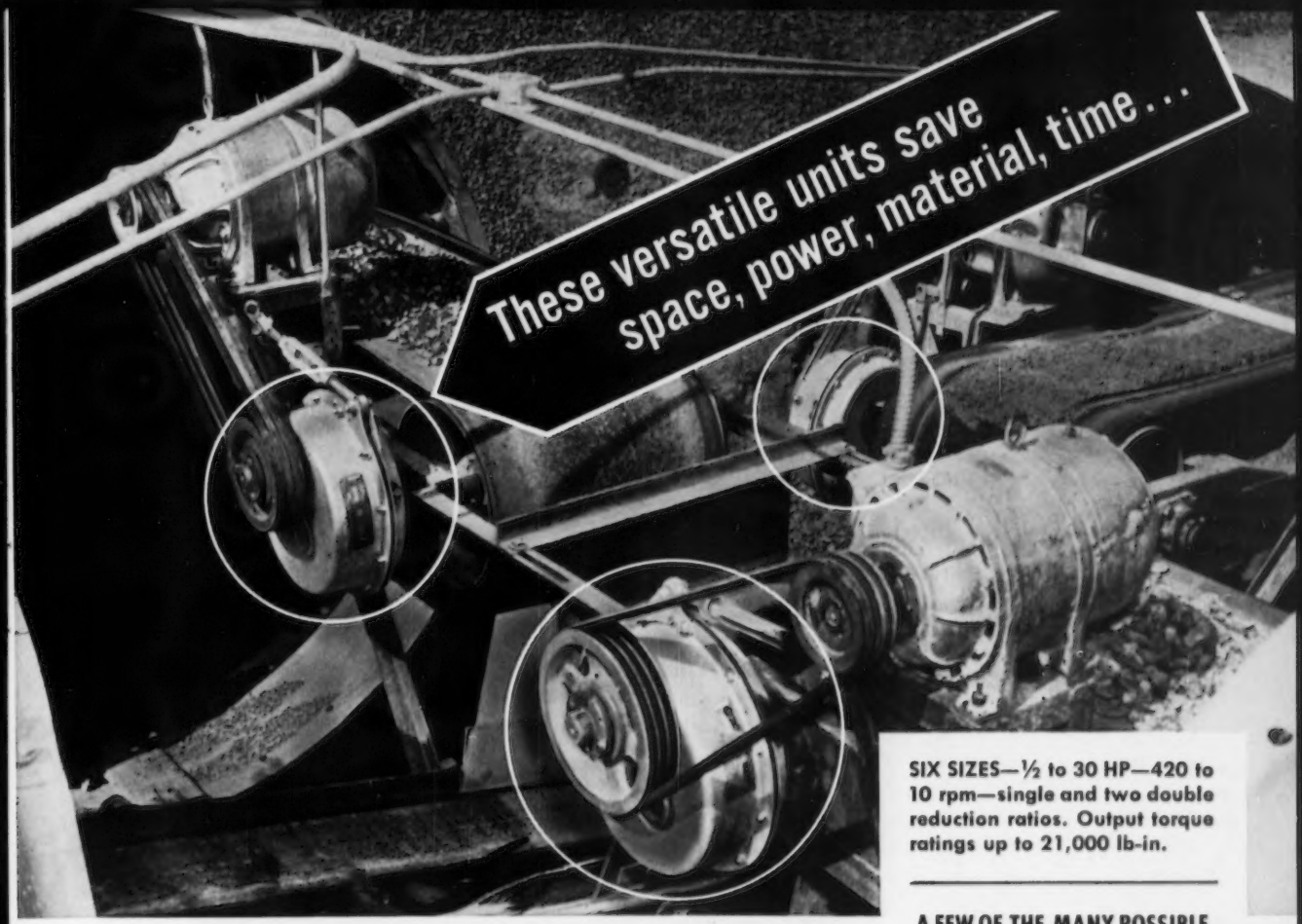

SIX SIZES—½ to 30 HP—420 to 10 rpm—single and two double reduction ratios. Output torque ratings up to 21,000 lb-in.

FALK ALL-STEEL Shaft Mounted Drives

The photograph above typifies the way FALK Shaft Mounted Drives furnish the economical solution to problems of efficient speed reduction in a limited space. Within their rated capacities, these versatile reducers are designed to drive any machine and to fit any space requirement.

FALK Shaft Mounted Drives mount on the driven shafts and are connected by V-belt or chain to any convenient rotating power source. Unlimited choice of output speeds between 420 and 10 rpm is made possible by varying the ratio of driving sheaves or sprockets.

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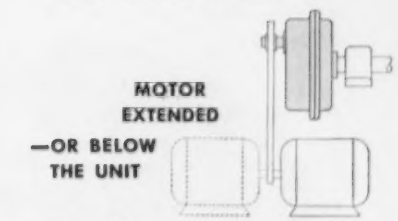
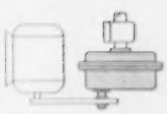
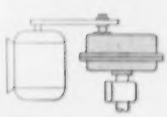
Promptly available from factory and distributor stocks, from *coast to coast*. Ask your Falk Representative or Distributor for details—or write us for **Bulletin 7101.**

A FEW OF THE MANY POSSIBLE DRIVING ARRANGEMENTS







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Now! A MAMMOTH for mining and quarrying

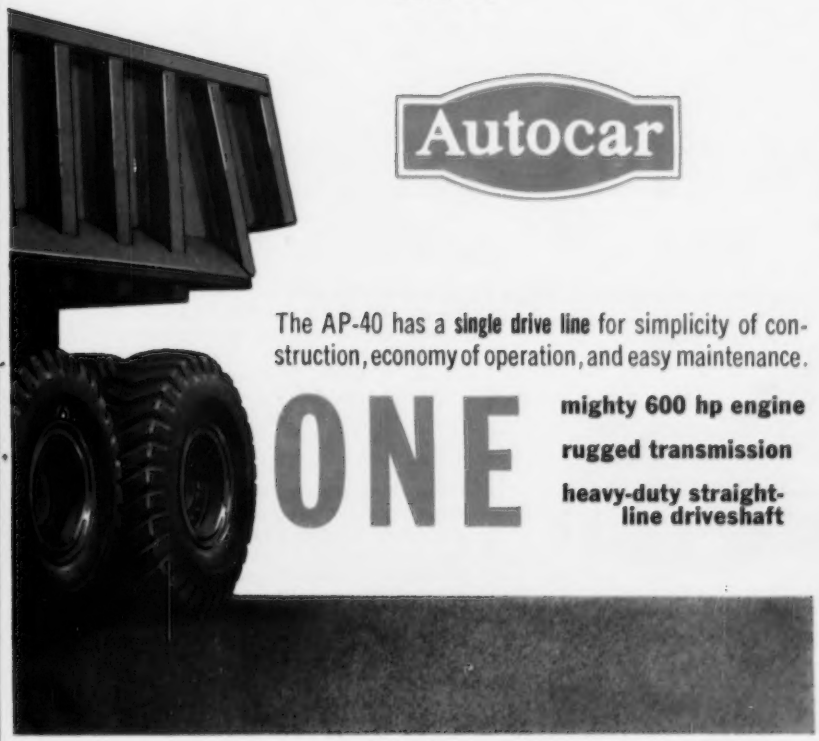
You can look to the Autocar AP-40 to provide a new way to profitable volume hauling. From face to breaker and back again, there's nothing to match its fast trip cycle. Under heavy, crunching loads and over a variety of grades, it provides extraordinary low-gear performance—and high-gear speeds between 25 and 33 mph. Its weight to horsepower ratio is 275:1—never before achieved in a heavy-duty truck.

AUTOCAR rated 40 tons

The strength of this powerful unit rests solidly on the tough torque-resistant box frame of 1-in. plate with corrugated internal reinforcement of ¾-in. plate. Seven cross members. Depth of frame under load area, 23½ in.; length, 27 ft. 11½ in., weight 16,800 lb.

AUTOCAR TRUCKS

Autocar Division, The White Motor Company
Exton, Pa.



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The AP-40 has a **single drive line** for simplicity of construction, economy of operation, and easy maintenance.

ONE

mighty 600 hp engine

rugged transmission

heavy-duty straight-line driveshaft

Here are a few of the massive features of the AP-40

Engine

V-12 turbocharged Diesel developing 600 hp, which means a weight to horsepower ratio never before obtained in heavy-duty trucks.

Transmission

A brand-new transmission, with 9 speeds forward and 2 reverse, specifically designed to handle the power of the 600-hp engine. This is the first vehicle built with this transmission.

Clutch

17-inch 2-plate clutch, manually actuated with air assist for ease of clutch pedal operation.

Clutch facing: Ceramic-metallic.

Axles

Tandem rear axles with planetary gears located at the outer end of the wheels for easy accessibility. Forward rear axle has a double reduction carrier. Rear rear axle has a single reduction carrier with a matching ratio. Interaxle differential is of the 4-pinion, high traction type capable of transferring increased torque with the greatest possible traction.

Body

27-cu.-yd. heavy rock body with chute construction, exhaust heated. Full cab protector.

Hoist

Double acting, outboard mounted, telescopic type. Supports integral with frame. 70° dumping angle.

White Autocar

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MODERN DESIGN
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Today's Demands!

MORRIS PUMPS

keep the aluminum industry rolling toward

GREATER CAPACITY

In pace with the far-sighted aluminum industry, other leading manufacturers the country over shrewdly specify Morris for heavy duty pumping.

The Morris Type RX Slurry Pump is rugged, dependable, and trouble free. It's specifically designed for heavy pumping; gives peak performance under all conditions, including heavy, coarse or fine slurries, dispersions and sludges.

The Morris pump operates with minimum attention . . . lowers maintenance costs . . . can be quickly dismantled for inspection . . . avoids lengthy lay-up time. For heavy duty pumping specify Morris.

WRITE TO MORRIS TODAY for recommendations of the pump best suited to your size, capacity, specifications. Ask for Bulletin 185.

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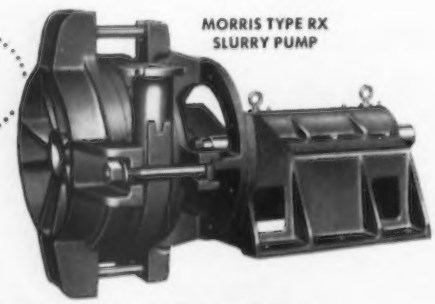

MORRIS TYPE RX
SLURRY PUMP

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
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Michigan *(Continued)*

field mine in 1956, will ship only from stockpile there in 1957. North Range Mining Co., which took over the Penokee at Ironwood in 1954, and shipped 445,864 tons in 1956, is again producing this season. The mines which now comprise the Penokee were begun about 1887 and were operated by the Oliver Iron Mining Co. for many years. Republic Steel Corp. leased the properties in 1936.

Electrical modernization at the Hiawatha No. 1 and No. 2 mines which has been carried on for the past few years has been completed. Feeders of the main distribution system at the shafts of both mines have been replaced with several thousand feet of new high voltage cable to serve the underground mining and pumping loads. High voltage air-break switches have been installed to provide safe switching for vital underground loads on the various operating levels.

MINNESOTA

M. A. Hanna Co. has begun work on development of the Norpac mine in North Hibbing, recently released by agreement with the Village of Hibbing. The Norpac, which lies between Oliver's Hull-Rust and Pickands, Mather & Company's Scranton mines, has an estimated reserve of about 7-million tons covered by an average 100ft of overburden.

The 30 cu yd dragline, which was used in stripping the South Agnew and Morton mines, has been moved over four miles of difficult terrain to the Norpac and is now in operation.

Pacific Isle Mining Co. is stripping the old Iroquois mine at Mt. Iron and will operate the pit when it is producing. The Iroquois adjoins Pacific Isle's Wacootah pit. The Iroquois was operated by Rogers Iron Mining Co. from 1903 to 1914 when its last shipment of 14,334 tons was made. Total shipments have been 1,358,412 tons with an estimated tonnage of more than one million tons remaining. The fee of the mine is owned by Inland Steel Co.

Governor Freeman has signed a bill which permits the taconite industry to deduct special taxes, now imposed for construction of schools and governmental buildings, in computing the occupation tax. Other bills have been signed which extend taconite state leases for 25 years. Both were urged by the mining companies.

Oliver Iron Mining Division's new ore sizing plant at Chisholm, which will process direct shipping ores from the Sherman and Monroe groups is progressing according to schedule and will be completed this year.

Oliver's schedule for the 1957 season exceeds 35-million tons with an employment total of about 7,100. Over 26-million tons of stripping was moved during the winter months. Its only operating underground mines at present are the

Illustration from Agricola's De Re Metallica (1621)

only the richest ores could be processed

Back when they had to be processed by hand, only the richest ores were refined. For—even though manpower was practically free—the methods were so crude that too much of the valuable metal was lost.

Today, ore bodies that were ignored only a few decades ago are being processed profitably. This is due in large part to efficient grinding mills that turn out many tons of properly sized ore every day . . . mills that often utilize CF&I Grinding Balls and Rods. Always made from special analysis steel with the ideal balance between toughness and hardness, CF&I Grinding Balls and Rods assure optimum grinding ability and maximum wearability.

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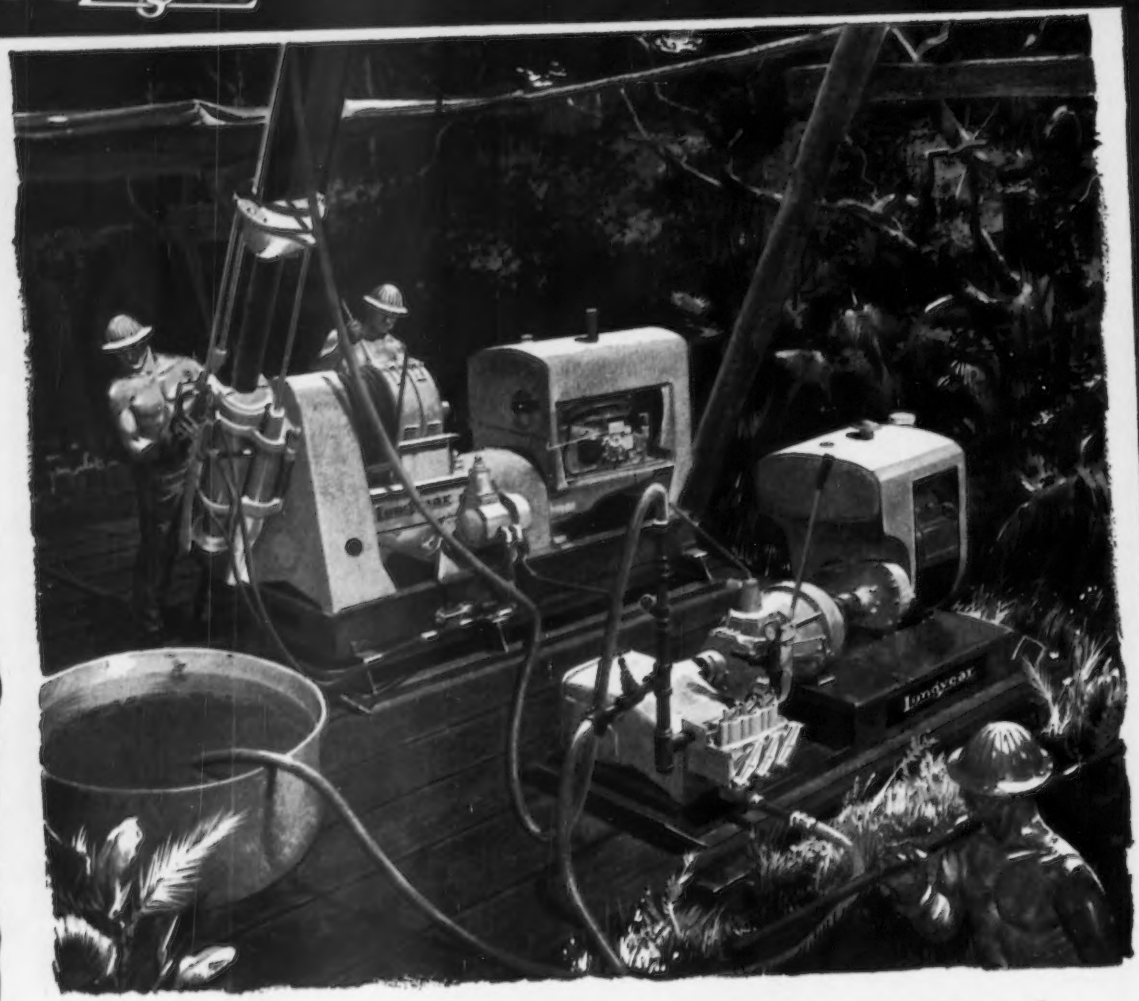

The drill crew **without a pumping problem!**

They depend upon the versatility of a Longyear transmission pump

Today this drill crew started a new hole, pumping as much water as possible through a rock bit. Next week, or next month, they may be pumping 5 gpm at 400-500 psi and doing it *without bypassing . . . without throttling down . . . without changing liners . . . without changing pumps.* Rock bitting or fishtailing, coring at moderate depths or deep hole coring—their Longyear Transmission Pump satisfies *every* drilling condition.

Three Big Advantages

Because they selected a Longyear transmission pump, this drill crew has three important advantages. They:

1. Control pressure and vary water supply over a wide range by shifting gears.
2. Maintain proper engine speed to minimize carbon deposits, get maximum life from engine and pump.
3. Eliminate bypassing, can drill with a closed circuit.

Advantages of Closed Circuit Drilling

Closed circuit drilling permits the use of Longyear Wire Line or "L" series core barrels equipped with water shut off valve.

The instant a block occurs, increased pump pressure followed by discharge of water through the relief valve alerts the operator. This minimizes the chance of human error in detecting a block, substantially increasing core recovery.

The crew knows that the water is reaching the bit instead of escaping through a bypass—and bit costs are reduced. Fishing jobs brought about by burned or mudded bits are virtually eliminated. This one feature can more than pay for the pump.

Shown in the drilling scene above is the Longyear 535RQ Pumping Unit. Featuring a five-speed transmission, this unit pumps as much as 35 gpm, as little as 4.5 gpm at pressures up to 500 psi. Gasoline powered—also available with Diesel or electric power.

A Longyear Pump For Every Need

Experience has shown that you can't overestimate the importance of *selecting the proper pump for the job.*

Longyear offers a complete line of pumping units for every drilling need. We will be happy to send you full information on our entire line of transmission and single-speed pumps.

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THE WORLD IS OUR WORKSHOP

Minnesota *(Continued)*

Pioneer and Soudan on the Vermilion range. The Pilotac plant at Mountain Iron will handle about 2.5-million tons of crude taconite from the Mt. Iron pit.

NEVADA

Adventures, Inc., headed by Norman E. Hanson, of Basic, Inc., at Gabbs, has taken a lease with option to buy on several mining claims in the Sunrise and Ludwig mining districts of Lyon County. All are patented claims owned by the county and are designated as Homestead, Porcupine, Snow Bog, Hollie and Myrtle, Great Western No. 1, Great Western No. 2, Ludwig Copper, and the Cobalt and Nickel mine.

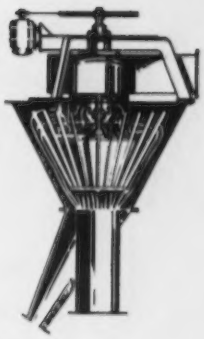
Coast Mining & Development Co. Inc., has resumed work on the Bonanza Silver property in the East Walker River district of Lyon County. Spring camp has been established and work is in full swing as a result of early warm weather. Assays of exposed veins show high values of silver per ton, as well as copper and lead. Work started last September consisted of construction of 4 miles of road and the opening of several veins. Operations were halted when weather got too bad. The firm has established headquarters in Yerington.

Three University of Nevada chemists have completed two years of tests on a new and rapid method for assaying for uranium. They are Dr. H. J. Seim, Dr. Robert J. Morris, and a graduate student, D. W. Frey, who developed the method while working on the Atomic Energy Commission research project at the University. The new method permits 20 analyses per day by one man, and is reportedly cheaper than the older methods. It makes use of ion exchange resins and is adopted from original investigations by resin manufacturers.

White Caps Mining Co. has installed a Fairbanks Morse pump at the bottom of the 800-ft shaft of the White Caps mine at Manhattan and has been pumping steadily in preparation for the resuming of mining operations this spring. In 60 days the water level was lowered 300 ft, and examination of the shaft proved it to be in excellent condition. Plans call for pumping out all water to the 800-ft level, then cross-cutting directly over the orebody which was opened by the Kirchen & Cole interests, in a winze on the 1300-ft level. High grade gold ore with a width of 34 ft was uncovered by the Kirchen & Cole interests in 1926, and present operations include plans for blocking out this orebody by diamond drilling. Antimony and mercury ore has been located in the upper levels of the mine.

A total of 407 members of the American Institute of Mining, Metallurgical and Petroleum Engineers accompanied by 140 women, attended the 1957 Pacific Southwest Mineral Industry Conference in Reno early in April. It was the first

change from...
40 MESH
to
400 MESH



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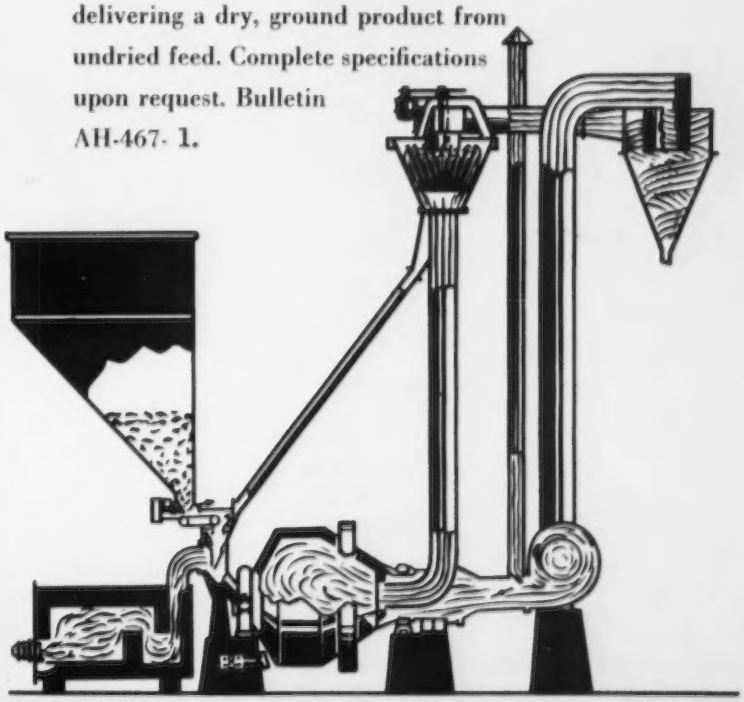
The Hardinge Gyrotor Classifier system, combined with a Hardinge grinding mill is an integrated grinding, classifying and product conveying system. Also available with an air-heating furnace for delivering a dry, ground product from undried feed. Complete specifications upon request. Bulletin AH-467-1.



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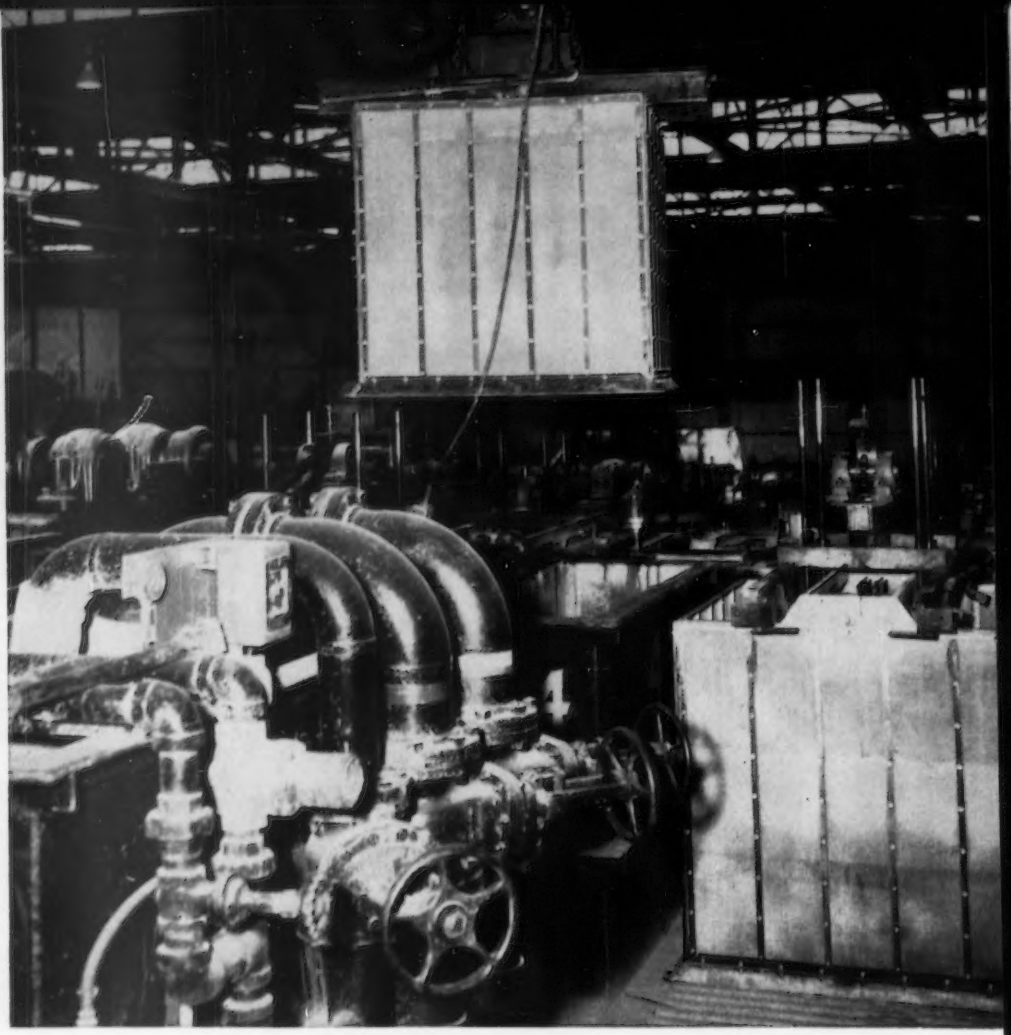
Stainless Steel valves and piping at acid storage tanks.



Stainless Steel baskets containing ion exchange resins. Adhering sulfate ions are stripped with ammonium nitrate solution.

Stainless Steel passes acid test

at Anaconda's uranium acid leaching plant in Bluewater, N. M.

You've probably read about Anaconda's Bluewater plant. It processes all the ore from the famed Jackpile Mine about 60 miles away. 700 men work here.

The plant uses a lot of Stainless Steel—but none of it is *replacement* Stainless. Using pilot plant data, and a solid background of chemical ore processing knowledge, Anaconda engineers designed with Stainless Steel right from the drawing board on. Stainless was selected wherever acid and abrasion resistance was needed and, in the words of Anaconda engineers, "Nothing else could do the job so inexpensively."

The process starts by treating the ground ore slurry with sulfuric acid, so naturally Stainless Steel is used for the acid piping and valves. But one of the most interesting applications is further down the process line, where ion exchange RIP banks are used to remove the uranyl sulfate radicals from the muddy solution. Big four-foot-square Stainless Steel screen baskets containing strong base resins are agitated up and down to do the job. The Stainless screening, impervious to the acid, will not corrode or "blind," and a full flow of solution can penetrate to the resin.

Like other users, you will probably find that the most economical way to use Stainless Steel is *right from the beginning*. You'll also find that it pays to specify USS Stainless Steel to be sure of service-tested quality.

Watch the **United States Steel Hour** on TV every other Wednesday (10 p.m. Eastern time).

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9600 HOURS WITHOUT DOWN-TIME

Since they switched to GM Detroit Diesel Power

Old Hampshire Coal Co. repowered this 4-yard dragline with a General Motors Detroit Diesel 6-110 engine in 1954. In its first 16 months this 2-cycle Diesel worked 20 hours a day, 7 days a week, with *not one minute's down-time.* Job Superintendent Melvin Lipscomb reports the "110" received its first overhaul at 9600 hours. His records show a 50% reduction in yearly maintenance expense over the 4-cycle Diesel it replaced—*and a 33% increase in production!*

This high-powered 2-cycle engine accelerates rapidly—responds to load instantly. It delivers a smooth, steady power output—twice as many power impulses for each revolution of the crankshaft. It starts quickly. Its clean, simple design makes maintenance much easier. And parts and service are readily available when needed.

Add up these advantages and you'll see why GM Detroit Diesels are taking over so many tough jobs in mining. Next time you need new equipment—or repower old—be sure to specify Detroit Diesel. *It does more work at less cost!*

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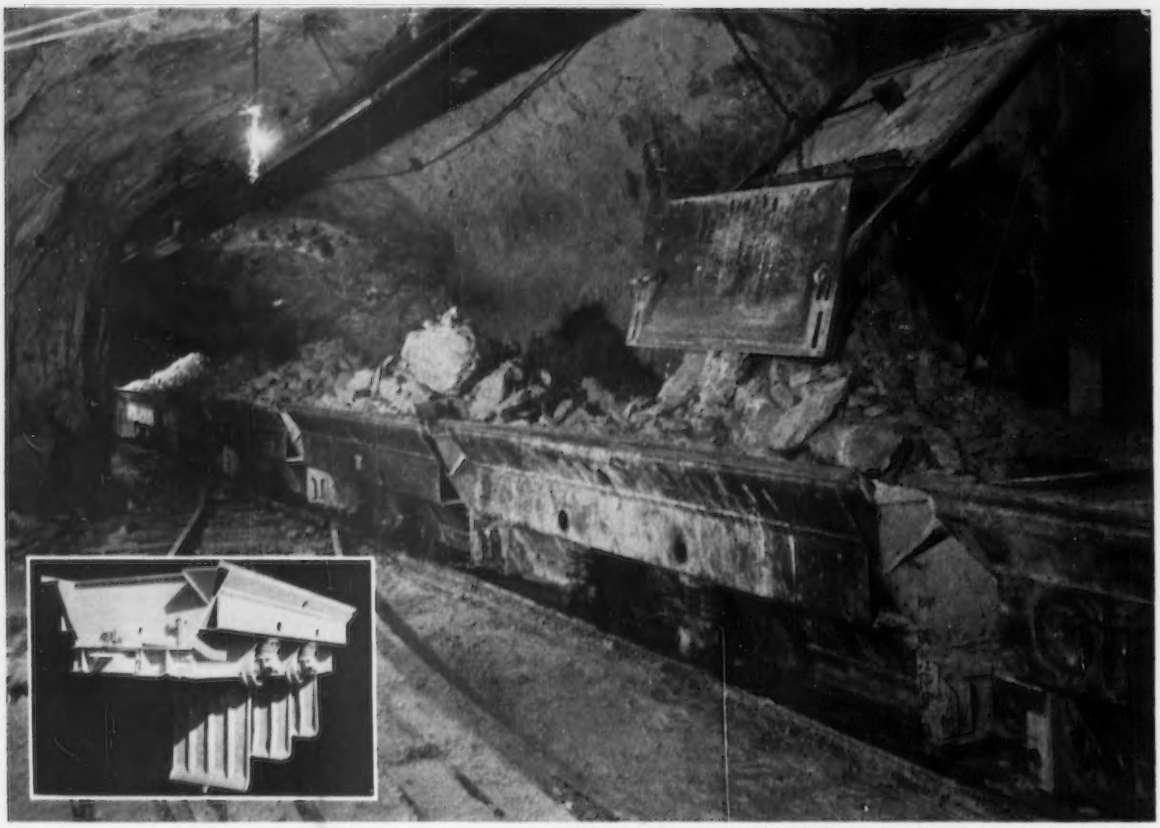
A GM Detroit Diesel "6-110" powers 4-yd. dragline owned by Old Hampshire Coal Co., Keyser, W. Va.



Locomotive operator moves and loads the trip by off-track control located at chute

They chute rock into S-D Automatics and get a One-Man Haulage System!

This metal mining company installed these S-D Automatic Bottom Dumping Mine Cars at a new mine after experiencing the economies of S-D Automatic One-Man Haulage at one of its older operations . . . including years of service proving that S-D Automatic sides and doors daily take the beating of large chunks of rock loaded from chutes. There, on a 3,000-foot-long-haulage, one man and a locomotive with six S-D Automatics load and transport the entire daily tonnage, averaging 850-tons and handle all men, supplies and miscellaneous services.

If all this equipment were abandoned and trackless haulage was substituted even without cost, they could not afford to convert this system to trackless methods or any other kind of haulage, the reason being apparent!

S-D Automatics dump and re-close automatically on-the-move, without extra labor, into any size storage bin — the key to economical transportation of any material.

Because the same tremendous reduction in cost per ton is available, we believe the day is coming when bottom dumping mine cars will be as popular in metal mining as they are in the bituminous coal industry today. As the super market for all types of mine cars, we believe our experience with the designs of every type of car haulage is of value to you. When we state S-D Automatics are worth looking into, we mean that, with few exceptions, S-D Automatics provide the most efficient and by far lowest cost method of main line haulage! Together we can intelligently discuss your present or anticipated future requirements as to how much S-D Automatics can save you! Our invitation to help you is genuine. May we hear from you?

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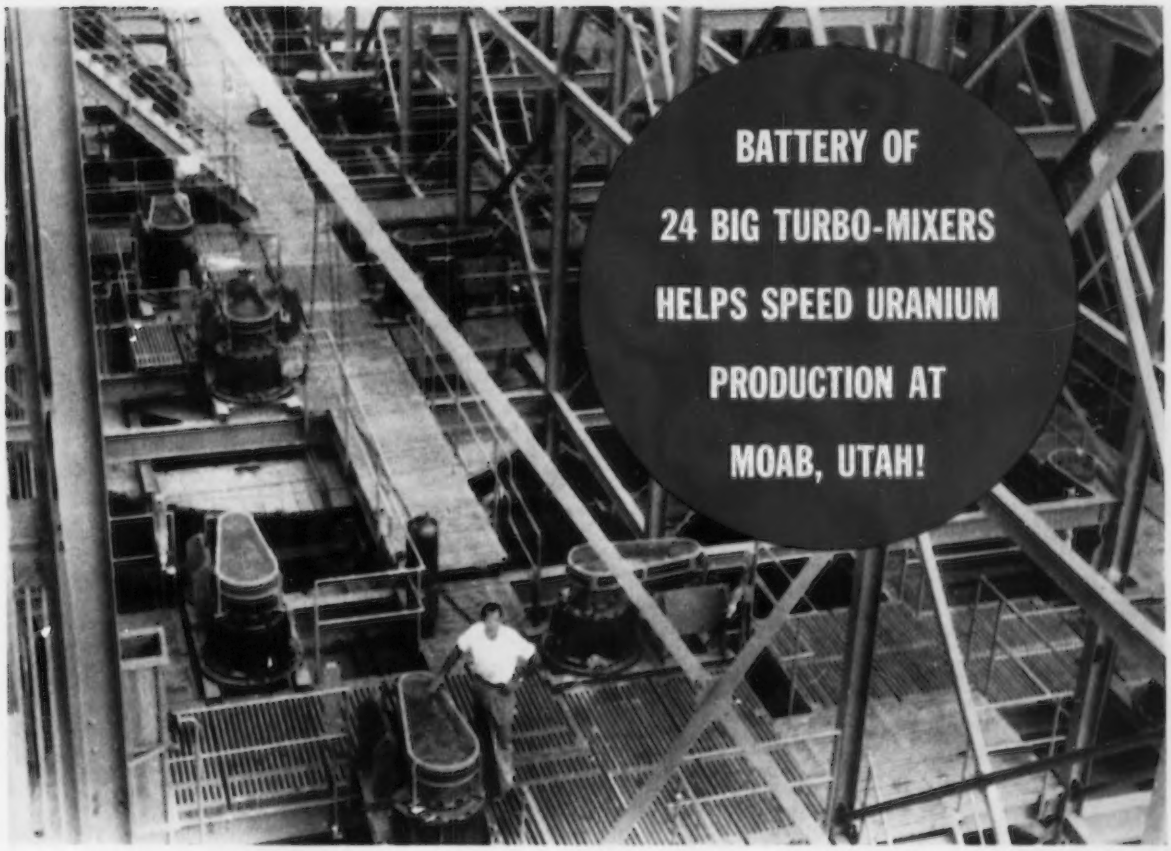
"SUPER MARKET FOR MINE CARS" — all types ★ PRECISION WHEELS ★ "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS ★ GISMO SELF-LOADING TRANSPORT that loads (mucks) in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton! *Sanford-Day Iron Works, Inc., Knoxville, Tennessee.*



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Uranium Reduction Corporation operates some of the largest leaching units in the industry—eight of their ten big leaching tanks depend on three 30-H.P. Turbo-Mixers per tank to suspend over one and one-half million pounds of uranium ore on a continuous flow basis. These Turbo-Mixers have operated without interruption since the plant went "on stream." Other Turbo-Mixers in the Metallurgical field are handling slurries of 75% to 80% solids. Turbo has specialized in this type of mixing for over 30 years. We'll be glad to tackle your difficult suspension problems or to conduct laboratory or pilot scale demonstrations with your observers.

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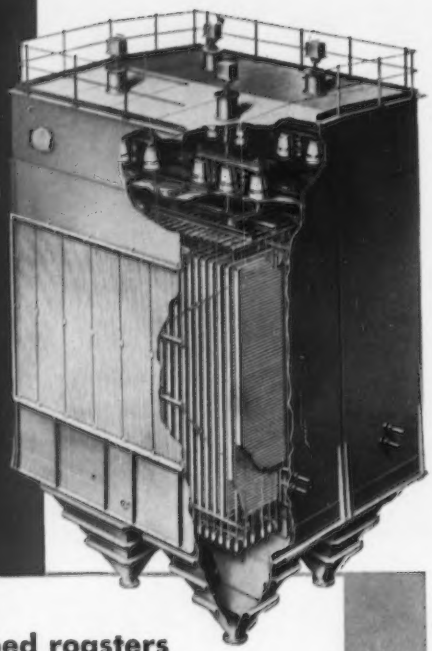

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Nevada *(Continued)*

of three conventions to be held by the Western Sections. Technical papers were read, and two symposiums were held, one on mining and one on metallurgy.

NEW MEXICO

A new 1700-ft concrete-lined shaft is being sunk in the Carlsbad Potash Basin for Farm Chemical Resources Development Corp. by McKenzie & Whittle, contractors. The 15-ft 2-in. dia shaft is the third one sunk by the contracting firm in the Basin, the first two at National Potash Co.

According to James A. Lilly, of McKenzie & Whittle, the first 65 ft was sunk and collared March 16, 1957. "Using our own form system," Lilly reports, "and our own drill jumbo and a modification of our previous mucking system, we are getting into stride." A 60-ft section was completed in one week in early May at a depth of 365 ft.

Credit for design and fabrication and application of the safety dumping door at National Potash Co. shaft, which appeared in *E&MJ*, April 1957, p 116, omitted the name of McKenzie & Whittle, Contractors, who did the job.

NORTH CAROLINA

A bill aimed at assisting the Lithium Corporation of America with a stream pollution problem was introduced in the North Carolina Legislature April 17.

It would give private individuals the right to exercise the power of condemnation to acquire land if the State Stream Sanitation Committee or the State Board of Health rules their acquisition of the land "is necessary in connection with the limitation or control of a substantial pollution or the substantial reduction of the pollution of any of the waters of the state."

Rep. B. T. Falls of Cleveland County, who introduced the measure by request, explained that the Lithium Corporation plant between Bessemer City and Kings Mountain, N. C., has used water from a pond on its premises to clean its minerals, and the State Stream Sanitation Committee has ruled that water from the pond could not be dumped directly into streams in the area but could be released if it were fed through another pond on adjoining land.

However, the party who owns the pond on the adjoining land wants $1,000 an acre for the land, or $40,000 for the 40 acres that would be needed, he said.

OREGON

More than 300 registrants and 28 technical papers made the Pacific Northwest regional conference of AIME in Portland April 11 to 13 one of the most successful in the ten year series.

A highlight of the session was a tour

New Timken® bit for air-leg drills and light stoping . . .

NEW TAPERED SOCKET
gives more secure union

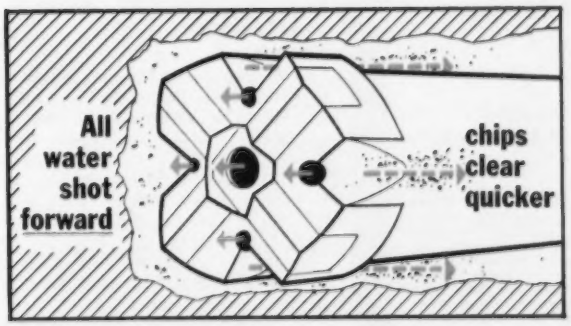
NEW FRONTAL DESIGN
speeds chip removal

You can lower your cost per foot-of-hole with this new Timken® tapered socket bit. With its uniformly tapered socket, the new Timken bit gives a more secure union for feed-leg drills. The precision-made taper fits tight to the drill steel, reduces breakage.

And the bit is removable, lets you make quick, easy bit changes. You drill out full steel life.

The new frontal design, with its specially positioned five front holes and deeper, wider wing clearance, speeds chip removal. Drilling goes faster, costs are cut even more.

Special analysis carbides give superior wear-resistance with added shock-resistance. And the new Timken tapered socket bit can be reconditioned many times to give you more feet-per-bit. Comes in 3 popular sizes: 1¼", 1⅜" and 1½". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



How New Frontal Design Speeds Chip Removal. The new five front holes direct air or water with jet-action velocity against face—wash away chips faster. Deeper, wider clearance between cutting wings works in unison with five front holes to give speedier removal of Rock Cuttings. Tests show these new features speed drilling, lower your cost per foot-of-hole.

TIMKEN MULTI-USE BIT (left) with correct, controlled reconditioning gives lowest cost per foot-of-hole when full increments of steel are used. **NEW TIMKEN THREADED CARBIDE BIT** (right) for other tough jobs. Improved thread contact reduces breakage. New wear-resistant carbides add life.

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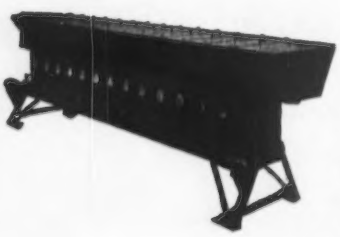
Efficient Mineral Separations with Negligible Man-Hour Cost

The SuperDuty® DIAGONAL-DECK® concentrating table operates virtually without attention. One man supervises as many tables as he can see. Forty or more tables in battery are easily checked, but whether the installation is large or confined to one or two tables, only minimum inspection is required . . . and identical efficiency per unit is readily obtainable.

For highest grade concentrates at low cost, with negligible loss to the tailings, and a reduced volume of middlings for recirculation, always specify the SuperDuty DIAGONAL-DECK concentrating table. For full information, send for Bulletin 118-B.



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This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each main cell. Advantages offered are: (1) accurate classification or sharp sizing, (2) easy and effective hydraulic water regulation, (3) as many spigot products as there are cells, (4) continuous discharge, (5) no moving parts, (6) low maintenance cost.

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Oregon *(Continued)*

to Albany, Ore., and inspection of the titanium operations there of Oregon Metallurgical Corporation and the two zirconium plants of the Wah Chang corporation.

Dredging concentration and chemical treatment of euxenite to recover columbium tantalum pentoxide, uranium and rare earths was discussed by Warren R. Wagner, Boise, Idaho, geologist, in one of the many papers which drew large interest. The paper detailed dredging operations by Porter Bros. corporation at Bear Valley, Idaho, where euxenite bearing placers were discovered in 1950.

W. A. Foster, geologist for the Hanna Coal & Ore corporation at its Riddle, Ore., nickel mining and smelting operations revealed that the Riddle deposits conservatively average 1.5% nickel. The ore, mined by open pit methods, is carried from the mine to smelter, a distance of 8306 ft with a 2,000 ft drop in elevation, by continuous aerial tram car.

Dr. Augustus B. Kinzel, vice president of Union Carbide Corp., told a banquet gathering that research is leading to accelerated progress in metallurgy. He predicted rapid advances in finding new uses and applications for metals. He forecast increasingly important roles for metals such as boron, zirconium, vanadium and columbium. Attendance was large at all sessions.

Exploration to determine extent of reported nickel deposits in the Illinois Valley area of southwestern Oregon has been started by Nickel Corporation of America and its parent companies, Chemical and Metallurgical Enterprises, Ltd., of Salt Lake City, Utah, and New Delhi Mines, Ltd., of Toronto.

UTAH

Uranium King, Inc. has signed contract with COG Minerals, Denver, Colo., affiliate of Colorado Oil and Gas Co. covering U-K's operations in White Canyon District, San Juan County.

The deal calls for sharing on 40-60 basis (40 per cent to U-K) any profits from mining Uranium King's properties. U-K formerly had contract on split profit basis with Williston Basin Oil Exploration, Salt Lake and Wichita Falls, Tex., independent.

Louis Sherman, U-K secretary and manager in Salt Lake City, said the new COG contract also gives the Salt Lake firm a share in any profits from a pilot up-grading device COG has operative in the district.

However, COG has no volume contract to sell up-graded material to AEC or to a private mill.

New Park Mining Co. has concluded a ten year lease with option to purchase claims in the Ophir district of Tooele County with Silver Standard Mining Co.

New Park vice president Clark L. Willson said that diamond drilling and drifting in search of lead-zinc-silver ores would commence in 30 days off a 1,000 ft. haulage tunnel.

6 VACSEAL PUMPS have met the acid test!

Pictured above is a shipment of VACSEAL Pumps, part of a consignment to a large Canadian ore processing mill, where large-scale operation in the acid circuit has decisively proved that VACSEAL is the economical answer to their pumping problem. VACSEAL was chosen basically for its unique "vacuum" design, its proven capacity for handling acids, slurries, and suspensions without gland water dilution. VACSEAL excels in the handling of valuable materials where slurry dilution and liquid losses must be avoided.

Materials being pumped by VACSEAL do not come in contact with the shaft or shaft sleeve when in operation. Wear of vital parts is thus reduced to a minimum. VACSEAL'S semi-open impellers give further assurance of long, trouble-free operation.

VACSEAL Pumps are manufactured in six sizes, capacities ranging from less than 20 to over 3,000 gpm. Pumps made acid-proof at low additional cost. Both rubber-lined types and alloy models are available. Any special information you require will be cheerfully supplied. Galigher has the answer to your "pump" problem.

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Bemis BANG Bags are made of the same material as Bemis Waterproof (laminated-textile) Bags, proved through years of use in many industries.

Need burlap overslips for explosive bags . . . or multiwall paper explosive bags? Bemis is your best source of these, too.

Write or wire for samples, prices and complete information.

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Utah *(Continued)*

Some 581,564 acres of Federal public domain in San Juan, Iron, Garfield and Kane counties in southern Utah has been restored to mineral leasing and mining claim location by action of Undersecretary of Interior Hatfield Chilson.

Minerals Engineering Co. and affiliated Salt Lake Tungsten Co. have announced reopening of mines, mill and refinery in Montana and Utah for production of tungsten in competition with foreign importers.

Blair Burwell, Jr., general manager of Salt Lake Tungsten, said substantial contracts had been completed with Molybdenum Corporation of America; Firth-Sterling Corp., and Sylvania Electric Products Corp., Inc.

The WO_3 will be sold in the $20 a unit range.

In view of the $8 a unit tariff on foreign tungsten, Minerals and Salt Lake Tungsten believe they can undersell the foreign output, Burwell said.

He stressed that the resumption of mining at Calvert Creek and Red Button properties near Glen, Mont., was made possible only by recent development of large tonnages of good grade ore which can be mined on open pit methods at these properties.

He estimates the reserves at between 300,000 and 500,000 tons.

United Park City Mines Co. and Daly Mining Co., have proposed merger. The latter firm, controlled 91% by UPC, owns the No. 2 Ontario drain tunnel in the Park City district.

Merger would eliminate a good deal of bookkeeping and open new areas for exploration. Special stockholder meetings are scheduled late in May to effect the change.

Mining of the Col-U-Mex orebody will commence shortly, officers of the Standard Uranium Corp., Moab, and Col-U-Mex, an Albuquerque, N. M. firm, announce.

WASHINGTON

Bunker Hill Co., Kellogg, Idaho, disclosed that it is doing some geophysical survey work at the old Bonanza lead mine near Colville. Roger H. McConnel, company geologist, said the firm has an option to purchase the property.

He said the survey probably will include some diamond drilling. The option was obtained from E. B. Gibbs, Colville, who took more than $2-million worth of lead out of the mine between 1914 and 1951, when it was taken over by Anaconda Company.

Anaconda turned the mine back to Gibbs and his former partner, Ira M. Hunley, Spokane, in 1953. The mine was originally discovered in 1885.

Anaconda Co. has optioned two copper prospects in the Cascade mountain area of central Washington, the firm's Northwest exploration office at Spokane said.

Forty claims about 2½ miles north of Snoqualmie Pass were optioned from United Cascade Mining Co., Seattle. Ananaconda built an access road to the property last summer and started a geological survey which is expected to be completed this year.

Also optioned is a property about 16 miles northeast of North Bend owned by Western States Copper and Uranium Corp., Seattle. Anaconda plans a diamond drilling program at this property in the summer.

Coffinite, a black uranium mineral, has been identified in recent ore at the Spokane Indian reservation, Don L. Hetland, Spokane, head of the Atomic Energy Commission's Northwest district office, said.

The ore came from the Lowley lease of Daybreak Uranium, Inc., on the southern tip of the reservation property. Mineral has an appearance similar to uraninite. Identification was made at AEC's Washington, D. C., laboratories.

WYOMING

A number of interests are seeking expansion of ore-processing facilities at Gas Hills District, Fremont County.

Lucky Mc Uranium Corp., (60% held by Utah Construction Co., world-wide mining company) has commenced negotiations with the Grand Junction Operations Center of AEC looking toward a hike in capacity of 750-tpd plant now under construction in district.

Globe Mining Co., Casper, which firm has encountered substantial reserves in exploration during 1956, is seeking a mill commitment from AEC.

This would make a third mill in the area, including the 400-tpd Lost Creek Oil and Uranium concentrator at nearby Crooks Gap in the same county. It is now going into production.

Meanwhile, Vitro Corporation of America (Vitro Uranium Corp. and affiliated Vitro Minerals Corp.) has come up with an altered proposal for its $1-million chemical up-grader about which previous discussions have been conducted with AEC.

The crux of the problem is this:

1. Ore reserves have grown significantly in the district; 2. Much of this ore is in the hands of companies and persons with no mill; 3. Lucky Mc's custom ore reservation at the mill is 20% of capacity and that of Lost Creek, 25%. This totals 250 tpd. It is not enough to take care of current or future custom output—particularly as concerns either Vitro or Globe.

Meanwhile, producers continue to be "rationed" in shipments to the Crooks Gap buying station operated by AEC. This is "temporary" until mills establish their own buying station.

Vitro officials confirm that their new plan envisages a "custom chemical up-grader" in which the Salt Lake mill, now undergoing expansion, would occupy a role of "refiner" to the up-grader. The details of the plan are lacking.

Meanwhile, Lucky Mc has developed substantial additions to its own reserves

HD-21 crawler tractor, 204 net engine hp
315 scraper, 20 yd heaped, 15 struck

YOU CAN STRIP OVERBURDEN AND RECLAIM LAND PROFITABLY

with this crawler tractor-scraper team

There is a marked trend toward reclaiming worked-out pits—and a parallel trend toward the use of Allis-Chalmers crawler tractors and scrapers. Both are examples of wise management.

Land Reclamation—already a law in many states—eliminates to a large extent the scarred and worthless landscapes left by abandoned pits and piles of overburden. Properly reclaimed land usually returns far more than the cost of reclamation in higher resale value. Even where pits can be only partially filled, the land may be seeded profitably for pasture.

Allis-Chalmers HD-21 Crawler Tractor and 315 Scraper are ideal for this type of operation. This team is mobile and flexible enough to strip overburden and spread it immediately in a worked-out area of the pit. This eliminates the need of re-handling overburden and of calling in specialized equipment.

Curved and offset cutting edge on the scraper, plus torque converter drive on the tractor, are just two of many features that put this Allis-Chalmers team in a class by itself for this type of work. Let your Allis Chalmers construction machinery dealer give you the details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

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If your present belts are being stretched beyond their take-up allowance . . . or if you're going to replace worn or damaged pulleys . . . change to Powerflex Hi-Capacity V-Belts. They permit you to use fewer belts and narrower sheaves . . . reduce drive costs.

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A TUNGSTEN CARBIDE INSERT BIT

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patents applied for

Lower first cost... Low cost per foot of hole drilled with

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the new bit you have heard and read about

Forged for Toughness

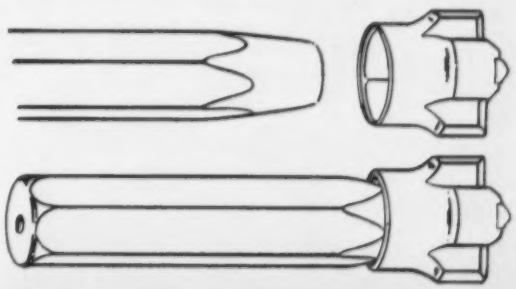
The Liddicoat Tee Cee bit body is produced entirely by forging. By a patented and exclusive manufacturing process, the hot alloy steel is subjected to tremendous pressure which extrudes the steel in the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the steel provides Liddicoat bits with an unusually strong tough body.

Longer Life from Interesting New Insert

In examining the Liddicoat Tee Cee bit, you will note the shallow tungsten carbide insert (patents applied for). It is the design of this insert that provides the unusual performance of the Tee Cee bit. Experience with the conventional multi-use insert bit indicates that the bit will usually dull at a given footage, the distance of course, depending on the type of rock. The dulling point of the multi-use carbide bit is not to be considered as the life of the Liddicoat single-use Tee Cee bit, for experience proves that the Liddicoat "used to destruction" Tee Cee bit drills far beyond the average dulling point of the multi-use Carbide bit.

Taper Socket—No Threads —Fast, Firm Attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal. The taper socket has been especially designed for the single pass Tee Cee bit.



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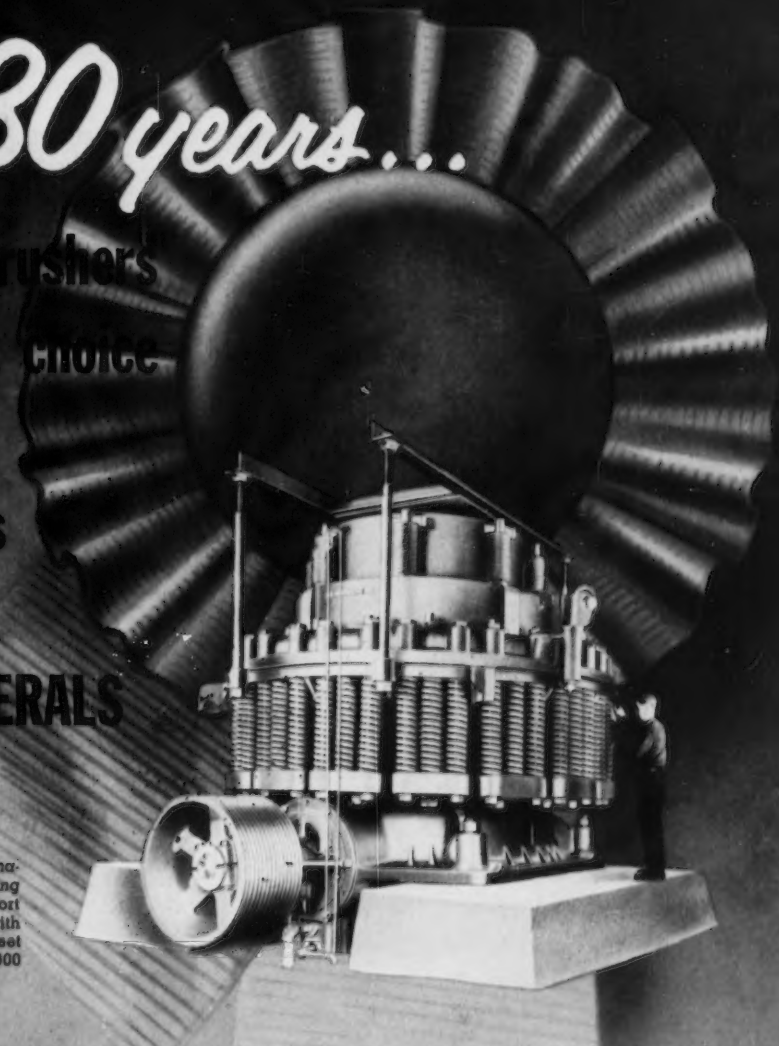

SYMONS CONE CRUSHERS . . . *the machines that revolutionized crushing practice* . . . are built in Standard, Short Head, and Intermediate types, with crushing heads from 22 inches to 7 feet in diameter—in capacities from 6 to 900 tons per hour.

The introduction of the Symons Cone Crusher some thirty years ago marked the greatest advancement ever made in the field of reduction crushing. The immediate acceptance of this crusher by producers of finely crushed materials has had no parallel with any type of machinery used for similar service.

The dominant position which the Symons Cone Crusher has so consistently maintained in over a quarter-century of service is positive proof of its vastly superior performance in processing big tonnages of finely crushed product at lower cost . . . *and is the reason why Symons Cones are still the first choice of the world's leading producers for volume crushing of metallic and non-metallic ores and industrial minerals.*

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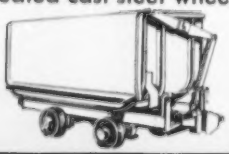
The tough ones come to Card

ANACONDA
solves maintenance by car standardization

Over 15 years ago, The Anaconda Company came to Card seeking the engineering of a side dump ore car that could serve a wide scattering of mine properties in Montana. Design requirements submitted by Anaconda called for long life in underground heavy-duty haulage and highly corrosive conditions.

About 1200 Card Granby-type cars are now in service in Anaconda's Montana operations. The latest designs differ in minor aspects from the original order, but all have proved highly satisfactory. The 115 cu. ft. car on 36" gauge has a high capacity to length ratio, keeping trains short. For maximum capacity, doors and back are internally braced. To ease loading shocks, the trucks are coil spring mounted, and the use of Card heat treated cast steel wheels with Timken bearings assure extended wheel life and easy haulage. Card engineers are happy to consult on any haulage problem. No obligation.



C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO

Wyoming *(Continued)*

through 1956 exploration programs and property acquisitions.

Susquehanna Corp. of Chicago announced that its plans for a third uranium processing mill in Fremont County are nearly completed.

Fremont Minerals Corp., a Susquehanna subsidiary, will operate the proposed mill if it is approved by the AEC.

Two uranium processing mills are under construction in the southeastern corner of the county. Lucky Mc Uranium Co. is building a $10-million plant capable of processing 700 tpd at Gas Hills, and Western Nuclear Corp is constructing a $7-million plant at Split Rock which can handle 450 tpd.

Governmental agencies seeking to obtain land or right of way by eminent domain will have to make a more concerted effort to give adequate notice to landowners or lessees under a recent decision of the Wyoming Supreme Court.

The Court held that newspaper publication of notice of intent to seize property by eminent domain is not sufficient in cases where the address of the landowner or lessee is known or can be ascertained.

"The ruling will place some burden on public officials to make reasonable effort to give notice rather than merely placing publication in a newspaper and leaving the entire burden of checking to the interested persons, the court said.

Possibly as much as 200,000 tons of iron ore samples may be shipped from low grade deposits in Fremont County to determine whether development of the area is feasible, the Columbia-Geneva division of U. S. Steel Co. said.

The ore shipments, which were to begin early in May, will be sent to U. S. Steel laboratories in Hibbing or Duluth, Minn., for tests.

Columbia-Geneva is contemplating a $16-million magnetic process mill in the Atlantic City area if exploratory work shows development of reserves.

Baroid division of National Lead Co is installing a laboratory in Lovell to test bentonite samples. The company has been doing exploratory work since 1953 on 270 bentonite claims located east of Lovell.

Veca Minerals uranium pit in the East Gas Hills area of Fremont County, is being expanded and further drilling conducted to delineate blocked-out ore on the Pix group of claims.

The present pit is about 55-65 ft deep, 350-400 ft long and 70 ft wide at the bottom. Veca ore is being shipped to the AEC buying station at Split Rock.

Phelps-Dodge Corp. has drilled 10,000 ft more than the footage required under its option agreement with Wyoming Uranium Corp. and is continuing work on Fremont County claims.

Hepburn T. Armstrong, president of Wyoming Uranium, said under the agreement Phelps-Dodge was to drill 82,000 ft, but by early April had completed 92,000 ft.

UNOBA Grease holds off the attacks of moisture, salt and blazing sun—a deadly combination of enemies to machinery.

In fact, Union's remarkable barium-lithium base UNOBA Grease has kept these ornery critters at bay year after year after year for this western salt-producer.*

For the lubricant that will protect your machinery under the most hostile attacks of weather, heat or corrosion, signal your nearby Union Oil representative for multipurpose UNOBA Grease. He's as prompt with help as the United States Cavalry.

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See how easily you can observe every phase of the operation of this open-type heavy-media vessel, and how readily it can be maintained. Then investigate: (1) Its simplicity; entire process is performed by one moving part; little to go wrong. (2) Its quiet pool surface with large productive separating area. (3) Its unique drive; no power transmission trains. (4) Its low installation cost. Examination will disclose this vessel's substantial economies in production and maintenance. Models for all HM needs.

Our pilot plant houses commercial-size HMS system

For details of OCC Vessel's unprecedented simplicity, Send for HMS Bulletin. Pilot plant testing service

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DIVISION: MINING & MILLING MACHINERY

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Wyoming *(Continued)*

Phelps Dodge has until June 30 to exercise its options on the holdings.

R. L. Moran, Riverton attorney, was reelected president of the Wyoming Mining Assn at its second annual convention in Casper April 12-13.

Glenn E. Sorensen, president of the Kemmerer Coal Co. at Kemmerer, was elected vice president and H. D. Hand of Globe Mining Co., Casper, was named secretary-treasurer.

Hand and Duncan Williams, Laramie, were elected as new directors to succeed Roy Coulson, Riverton, and Jack Lythcoe, Casper. Myron Sisson of Sunrise was reelected a director.

The association renewed its opposition to a severance tax on depletable natural resources and went on record favoring state, rather than Federal, safety regulations for non-coal mines.

Radorock Resources, Inc., 52% controlled by Federal Uranium Corp., has launched an exploration program on some 800 uranium claims controlled by two firms in the Gas Hills area of Fremont and Natrona counties.

Ralph W. Neyman, president of both Radorock and Federal, said that if reserves develop in the course of the search for commercial ore, Radorock will consider financing of concentrator facilities.

IN CANADA

ONTARIO

Algom Uranium Mines has ample reserves to meet its present sales contract of $206,910,000 and to continue in production for many years after its completion. Ore reserves at the company's Quirke and Nordic properties in the Blind River area are estimated at over 31-million tons averaging 2.43 lb uranium oxide per ton after dilution. This tonnage includes only the main horizon and comprises ore proven or fully developed by underground work and indicated by diamond drill holes with maximum spacing of 1,000 ft. The area covered is only one-quarter of what is believed to be the potential productive area of the Quirke and Nordic orebodies.

Canadian Dyno Mines is preparing to bring its Bancroft area uranium property into production by March 1958. New financing has been arranged for mill construction and mine development. Mill will have a rated capacity of 1,100 tpd. A shaft has been completed to 1,000 ft and extensive lateral work has been carried out on the 180-ft level with stations cut for five additional levels. Surface diamond drilling and underground work completed on three zones have indicated 2,250,000 tons averaging 0.09% uranium oxide, after allowing for 12.5% dilution. The company has a contract with Eldorado Mining and Refining for sale

an ACCO product

American Cable TRU-LAY VHS | 15% STRONGER

New VHS Dragline Lasts 73% Longer

Draglines on the excavator above, used in coal stripping operations at the Kingston Mining Company, Plymouth, Pa., get really rough service. The best Improved Plow Steel lines formerly lasted only 700 hours.

Now, however, lines of new TRU-LAY VHS are averaging 1,250 hours —giving 73% longer service life.

Records like these are being duplicated by VHS Draglines all over the country. For new VHS is tougher—more wear resistant. And it has all the advantages of preformed construction.

STRONGER AND SAFER

New VHS is 15% stronger than Improved Plow Steel, which was the strongest available until now. Its additional strength enables you to handle heavier loads with the same diameter line. And it gives you a higher factor of safety during the entire service life of the rope.

FOR SHOVEL HOIST ROPES AND SLUSHER ROPES, TOO

TRU-LAY VHS was developed particularly for the toughest applications in the mining industry — draglines, shovel hoist ropes and slusher ropes. It stands up better under the rough treatment these ropes necessarily get.

LESS "DOWN TIME"—CUTS COSTS

Because it is tougher and more wear resistant, TRU-LAY VHS rope lasts longer, costs less to use and cuts "down time" of equipment for wire rope replacement.

TRU-LAY VHS ropes are easy to order. Just ask for TRU-LAY VHS Shovel Hoist Ropes, Slusher Ropes or Draglines, in the size you want. You don't need any complicated specifications.

Your American Cable Distributor has TRU-LAY VHS *in stock now. See him or write to the nearest American Chain & Cable Company Office.*

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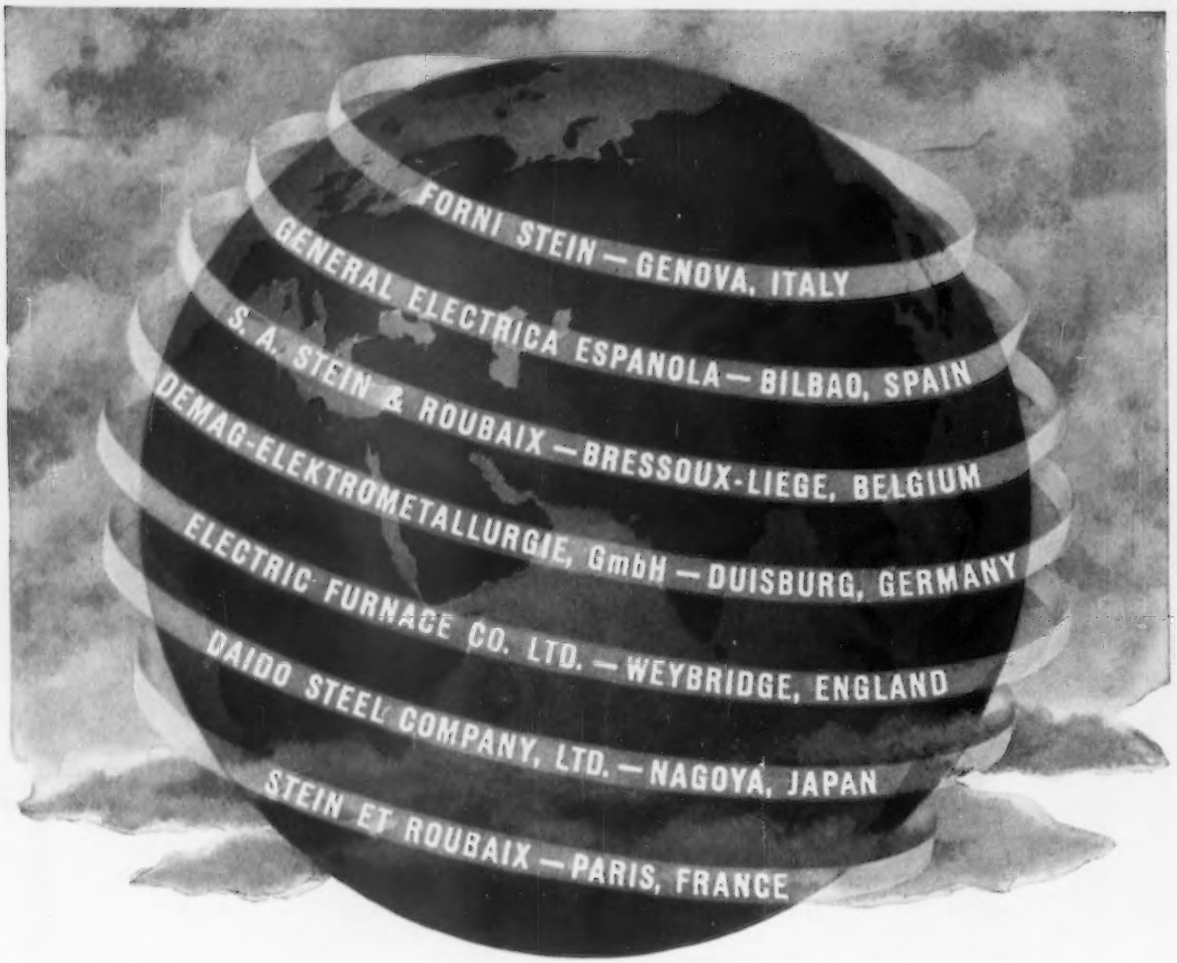
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A carefully selected family of companies all over the world are licensed to manufacture and erect Lectromelt furnaces. Together, we have installations from South Africa to Finland, Chili to Canada, Turkey to Hawaii . . . anywhere melting, smelting, refining and reduction furnaces are needed.

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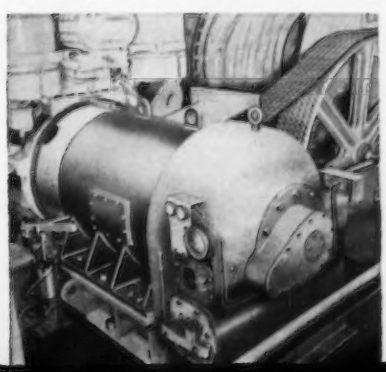
LIMA Type 2400 with Torque Converter moves overburden faster at lower cost

The torque converter, standard equipment on all LIMA Type 2400 machines, is another of the quality features that enable LIMAS to outperform and outlast ordinary machines. It automatically increases torque as required by the load, making higher output possible by avoiding stalling and making performance much smoother and faster.

For assignments calling for an electrically-powered 6-yard machine, the LIMA Type 2400 is available with complete electrical power package. Combining a single AC electric motor with a single stage torque converter, this drive matches, *electrically,* diesel-torque converter performance. You get maximum power performance under all operating conditions . . . and the motor won't stall or burn out.

Cable life is increased and machinery maintenance reduced because shock loading is minimized as the oil in the converter cushions any sudden blow. Friction clutches last much longer because the torque converter reduces friction clutch slippage during acceleration.

LIMA quality design and construction extras make for profitable, efficient operations with minimum downtime. There's a LIMA type and size for every job—shovels ½ to 6 cu. yds., cranes to 110 tons and draglines variable. Smaller capacities are available on rubber. For full details, contact your nearby LIMA distributor, or write Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Lima, Ohio.



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West End anhydrous **SODIUM SULFATE** merits your confidence for its consistent purity

Here is the new high standard of sodium sulfate quality achieved by exclusive West End production techniques and controls. The product is pure white and exceedingly low in heavy metal content. It is guaranteed 99½% minimum Na_2SO_4 yet actually runs 99.75% to 99.8% Na_2SO_4 typically. We invite your attention to the adjacent typical analysis and welcome your communication.

TYPICAL ANALYSIS

Na_2SO_4	99.5% or better
Na_2O	.05% max.
B_2O_3	.05% max.
NaCl	.07% max.
Insoluble	Trace
Loss on ignition	Less than 0.1%
Solution	Clear
Color	White
Fe	1 ppm
As	1½ ppm
Cu & Zn	Not detectable

WEST END

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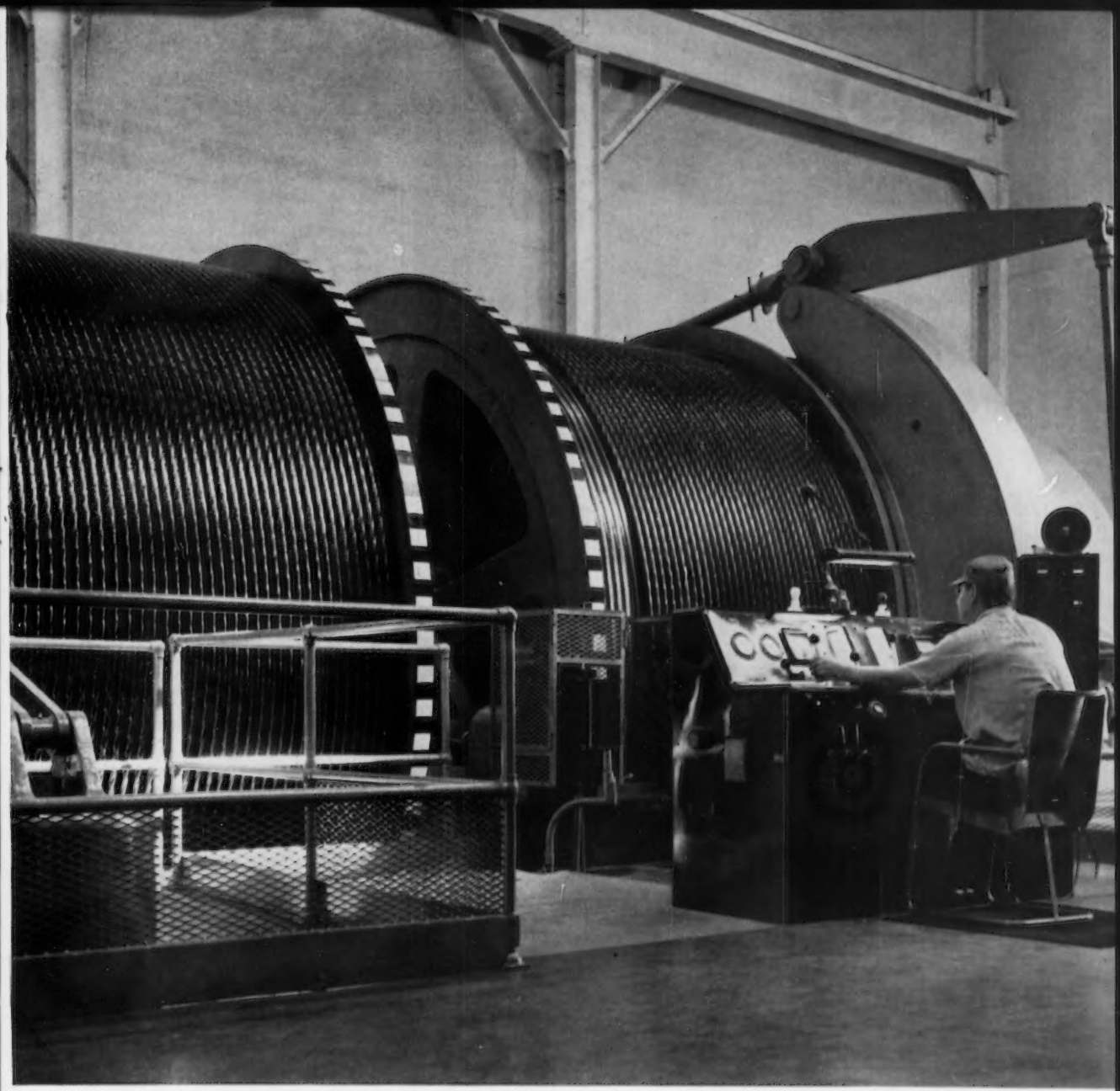


WIRE ROPE AT WORK

As an example of good housekeeping and all-around efficiency, this beautiful hoist installation would be mighty hard to beat. In service at an iron-ore mine, the powerful machinery is part of the balanced materials-hoist system. Each of the drums is equipped with several thousand feet of husky wire rope. A similar but somewhat smaller installation is provided for the cage hoist:

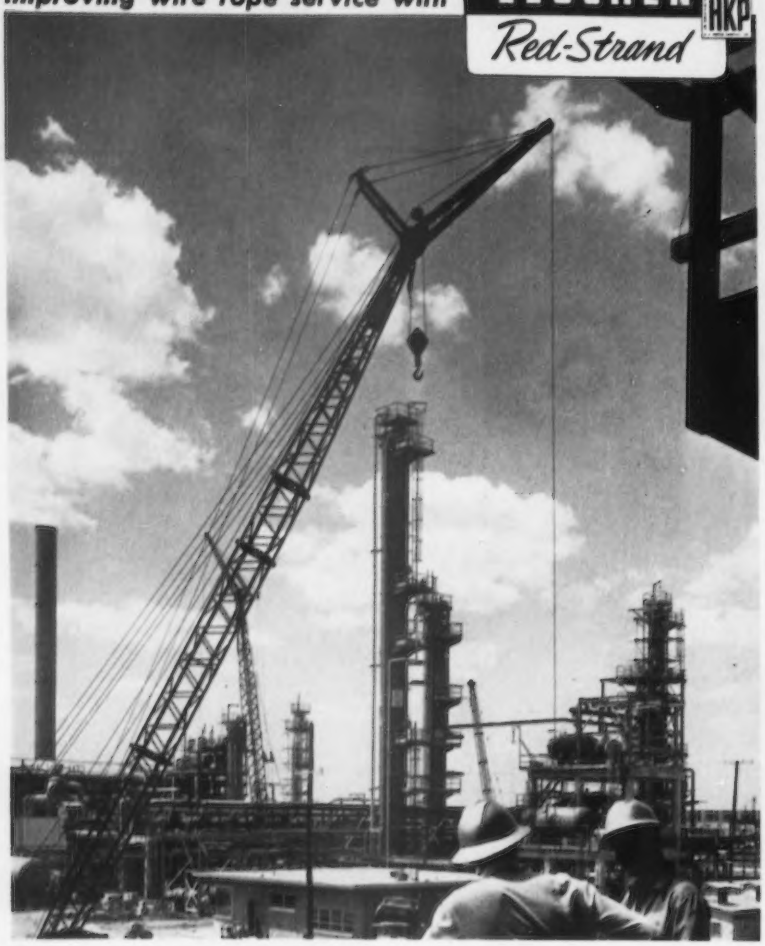
Those ropes so neatly spooled on the drums are Bethlehem flattened strand. They're big—2¼-in. diam. On the cage hoist (not shown in the photograph) the rope size is 1¼-in. Both installations use Purple Strand, of course—Bethlehem's top-grade rope with all the strength, endurance and toughness needed for heavy-duty mining applications.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING

Improving wire rope service with **LESCHEN** *Red-Strand* HKP



This one test proves which wire rope serves you best

"Problem jobs" may frequently make you wonder about the rope you're using.

Are you faced with unusual operating conditions? Is the rope the right type—size—grade—construction? Is greater tensile strength needed? Are you using the right brand?

The test is to use Leschen's on-the-job Service-Score Sticker reports. Keep the score—know the results—and questions are answered.

Then check with your Leschen man for engineering help. And, be sure to use Leschen's highest quality, service-proved Red-Strand wire rope. *Leschen Wire Rope Division, H. K. Porter Company, Inc., St. Louis 12, Mo.*

Write for Service-Score Fact-Folder

HKP LESCHEN WIRE ROPE DIVISION
H. K. PORTER COMPANY, INC.

Ontario (*Continued*)

of $34,816,070 worth of uranium oxide to the end of March 1963.

Milling operations have been started by Consolidated Denison at its Blind River uranium property. The first 3,000-ton capacity mill unit is to be brought up to capacity, while the second unit is scheduled to be completed about the beginning of August. The whole plant is expected to be operating at capacity later in the year.

QUEBEC

Union Carbide and Carbon Co. has joined with Perron Gold Mines to finance an intensive exploration program on the latter's 55-sq mile concession in the Cape Smith-Wakeham Bay nickel belt in Ungava. Plans include participation in a joint airborne electromagnetic survey and ground work including geological mapping and sampling. The ground program is expected to start mid-June.

Total production of iron ore in 1956 from the large concessions of Iron Ore Co. of Canada, Hollinger North Shore and Labrador Mining and Exploration in Labrador-Quebec set a new record of over 12-million tons, up from 7.7-million tons in 1955. Shipments by North Shore and Labrador for the current year are expected to be increased again by as much as 25-50%.

Quebec Lithium Corp., Canada's sole producer of lithium, is planning to start construction sometime this year on a refinery to treat lithium concentrates from its mine located some 25 miles north of Val d'Or. Details have not been worked out fully as yet. At the mine work is progressing on enlarging the present 3-compartment shaft to a 5-compartment opening. Completion of this program will permit increase in mill rate from the present 1,000 tons to rated capacity of 1,500 tons.

Dadson Lake Chibougamau Mines is carrying out a geophysical survey on its 14-claim base metal prospect in Opemiska Twp., Chibougamau area. Values in copper-gold-silver were obtained in limited prospecting by previous owners. Present program will follow up these indications.

Recent diamond drilling at the zinc-lead-silver property of Coniagas Mines in the Bachelor Lake area has indicated promising depth possibilities. Values have been obtained around the 1,000-ft horizon, or some 200 ft below any previous drilling. Plans are being completed for a 350-ton mill but this may be increased should results of further drilling warrant.

Golden Manitou is preparing to take a look at the new zinc zone indicated by drilling to 200 ft below the present bottom level at 2790 ft. A winze is being started from the 2790-ft level to about 3300-ft initially and to 3800 ft eventually. First stage of the sinking at

the Bourlamaque Twp. mine is expected to be completed this year.

The initial stage of shaft sinking to below 600 ft has been completed at the Chibougamau Jaculet Mines' copper prospect in the Chibougamau camp. Crosscuts are to be driven on the 300, 450 and 600-ft horizons with first objective to open the main No. 2 ore zone, some 300 ft south of the shaft. The drives will be continued another 600-800 ft south to open the No. 1 zone. It is expected to have both zones fairly well developed above the 600 level by mid-summer.

Operations at Rainville Mines, new copper producer in the Val d'Or area, are showing continued improvement. The mine is now nearing its first full year of production. Mill rate has been moved up to 460 tpd compared with 320 tons late last fall. Present average grade is running at 1.7% copper, against 1.59% for the first eight months of production. Development work from the new No. 2 shaft, located 2,200 ft from the No. 1, is expected to get under way shortly.

NEW BRUNSWICK

A diamond drilling program is to be carried out by Croinor Pershing Mines on its 66-claim base metal prospect in the Bathurst-Newcastle area. The property adjoins Kennecott Copper on the west and Anaconda on the east. Large tonnages of ore have been found in the area by both of these companies.

New Brunswick Uranium Metals & Mining under Rio Tinto management is carrying out exploration in the Hampstead-Bellisle Bay area. A total of 445 claims in 14 groups has been acquired by staking, while another 35 claims in two groups have been optioned. Rio Canadian Exploration has a 40% interest in the project. A number of anomalies were indicated by an airborne electromagnetic survey last fall and a follow-up is under way.

Estimated ore tonnage on the Captain Mines' property in the Bathurst-Newcastle area has been boosted substantially. Latest estimate shows 2.67-million tons averaging 0.174% cobalt plus values in copper and gold. The estimate covers a length of 400 ft, average width of 83 ft and depth of 800 ft. The company plans to undertake a shaft sinking program this fall when it is expected the railway being built into the Heath Steele property will be completed. The line will cross the Captain property within 1,000 ft of the ore zone.

NEWFOUNDLAND

Tilt Cove copper mine of Maritimes Mining Corp. is being prepared for production by October of this year. Construction work is progressing on the 2,000-ton capacity concentrator. Ore reserves are estimated at 3,941,717 tons

1 Quaker—Super Ironsides
Quaker Pioneer—Victor
2 Quaker—Ironsides Neoprene
Quaker Pioneer—Victor Neoprene
3 Quaker—Ebonite
Quaker Pioneer—Reliance
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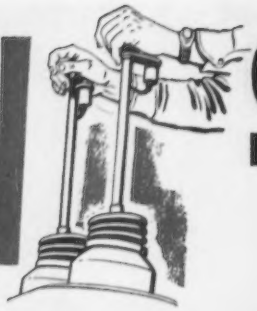

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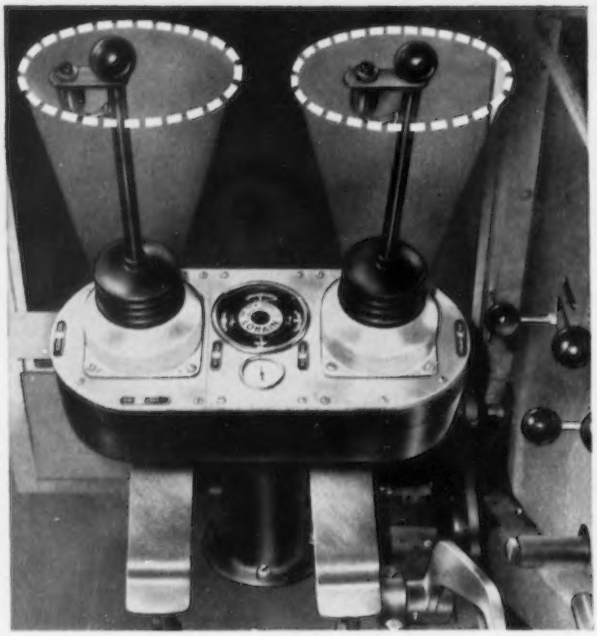
Reduce Operator Effort . . .
Provide Better Control

The latest Lorain advance brings a new era of operation to shovel-crane operators and owners. Now, Full-Metered "Air-Ease" operation controls all friction clutches. Now, two simplified hand levers replace the bank of awkward multiple levers of the past. These two levers put "Metered Air" to work feeding power to the clutches at any rate of flow desired. All of the old time "feel" and response is there, lever manipulation is simplified, effort is greatly reduced, speed is increased, control is more accurate. The range of air flow and power is at the precise command of the operator.

To the operator, here is a new day of operating ease and lack of fatigue. To the owner, no feature in years has added so greatly to production.

To be the first to put the new 2-lever "Air-Ease" control to work on your jobs, see your Thew-Lorain Distributor. Here is a feature your next shovel-crane should have!

THE THEW SHOVEL CO., LORAIN, OHIO



LEFT LEVER — Dotted circle indicates the "wobble stick" action. By positioning lever in various directions within this circle, operator can swing the turntable right or left, or raise the boom up or down. Intermediate positions within the circle combine any of these operations.

RIGHT LEVER — In the very same rotating action, the operator can control these operations: (1) Main Hoist; (2) Secondary Hoist; (3) Clamshell Holding; (4) Drag or Hoe Drag-in; (5) Shovel Crowd-Retract; (6) Third Drum; (7) Power Load Lowering.

All operations described above are controlled by moving these levers forward or backward, from side to side for single operations, or "quartering" the levers for combined operations. Air booster operation of Hoist Brakes is available.

IMPROVED VISIBILITY

This view shows the clean, simple, 2-lever control arrangement in the operator's cab. Operator gets full view of work area, particularly on deep digging operations.

Intermittently used Full Air controls for crawler steering, turntable swing lock, tread-travel lock, shifting of travel-swing jaw clutches, are conveniently located on panel to right of operator.

The new 2-lever Full-Metered "Air-Ease" controls are now available on eight Lorain models, both crawler and rubber-tire mountings, in 20 to 30-ton range.

THEW LORAIN

A string of 60-cu.-ft. capacity, COR-TEN Steel Granby cars, moving past the dump chute.

Rocker-dump car of COR-TEN Steel being loaded with rocks. 32-cu.-ft. capacity.

Thar's GOLD in them thar cars!

LITERALLY, because these Granby-type cars haul ore from the largest gold mine in the Western Hemisphere—Homestake Mine, in Lead, South Dakota. *Figuratively,* because they are made of USS COR-TEN Steel, which enables mining equipment to give far more service per dollar of cost than carbon steel.

Of the 500 Granby-type cars used in the mine, 410 are constructed of COR-TEN Steel. "We started replacing the old-style carbon steel cars in 1939 with our present-type COR-TEN Steel cars," says C. N. Kravig, Mine Superintendent. "The original 40 COR-TEN Steel cars, purchased in 1939, are still in service.

"The old-type cars lasted about ten years," adds Mr. Kravig. "We figure the COR-TEN Steel cars should last 20 years or more." Talk about Gold! That kind of service is as good as money in the bank.

In addition to the 60-cu.-ft. capacity, Granby-type cars, the mine also utilizes 511 rocker-dump, 32-cu.-ft. cars made of USS COR-TEN Steel. These cars are used, for the most part, to haul rock and fill away from the point where the mine is currently being developed. Thus, 921 of Homestake Mine's 1,011 cars are of COR-TEN Steel—a working testimonial to its resistance to abrasion and corrosion.

United States Steel produces three grades of USS High Strength Steel—COR-TEN, MAN-TEN and TRI-TEN "E." Possessing its own special characteristics, each is recommended for certain end uses where it will give longer service and greater economy. Yield point of these three steels is 50% higher than that of structural carbon steel, and in varying degrees, they offer greater resistance to wear, fatigue, abrasion and impact, and better resistance to atmospheric corrosion.

Write for further details: United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. Or, contact the District Office nearest you.

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Send in your bits that need resetting, giving full details of results obtained and conditions under which the bits were used. Prompt, accurate and dependable service assures you that they will be returned new and with the diamonds "Oriented". Generally, reset bits are on their way back to the customer within three working days. In many cases, suggestions for improvements in bit performance can be made after inspection of your bits, provided full details covering their use have been received.

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Newfoundland (*Continued*)

averaging 2.05% copper in two areas located about 2,000 ft apart. The property is at tidewater on the northwest coast of Notre Dame Bay.

BRITISH COLUMBIA

Government so far is adamant on the new policy of refusing Crown grants, although Minister of Mines Kenneth Kiernan states the government will guarantee mining interests continuity of title "essential to operation."

And least indications are that the industry will just have to get along without the grant system as well as possible, although the industry is drafting its own recommendations on what the regulations should be and will submit them to the government which has indicated it is prepared to study the proposals.

Mining people concede the new regulations are workable if the government provides "adequate security of title" to mining lands. But it is the government's discretionary power that has the industry worried since, as the Act stands now, the government can cancel a lease on a claim if not developed according to schedule.

It is now a matter of record that some companies have curtailed exploration and others have indicated they might pull out of B.C. altogether.

For example: Highland Bell Mines has temporarily shelved plans for a $200,000 exploration program in B.C. because, according to its president Karl J. Springer, the new amendments have created "an alarming situation."

The new tax on producing iron ore properties is to be implemented soon. It is expected to discourage the export of iron ore to Japan, to assist the establishment of a basic steel industry in B.C.

Western Mines' property near Ainsworth is to be worked by Consolidated Mining and Smelting. Initial work program calls for rehabilitating the Lakeshore tunnel, which will be extended to provide diamond drill stations for deeper drilling than was possible last year from the surface.

The Lakeshore level also will make possible development of the substantial tonnage of lead-zinc ore indicated by last year's program.

Rusty Creek Mining Co. Ltd., exploring a 36-claim property north of Lillooet, reports good values in copper and silver.

Samples from the main ore occurrence ran up to 11.3% copper and 11.6 oz silver per ton.

An adit is to be driven under the open pit on the main showing in preparation for diamond drilling.

The company believes that only a moderate amount of development will be needed to put the property into shape so that production plans can be considered.

Paving of the first 50 miles of the Alaska Highway from Dawson Creek to Fort St. John, B.C., is beginning this summer under direction of the Canadian De-

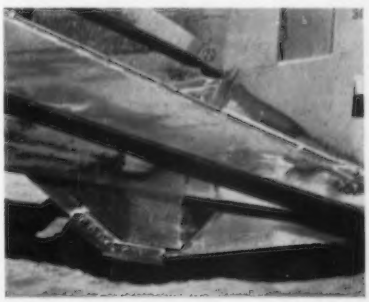
How STOODY HARD-FACING keeps STRIP MINING EQUIPMENT on-the-GO!

A few beads of Stoody Electric Tube Borium *keep the points of these shovel teeth out to size, while unprotected teeth lose a full inch of length in the same time.*

Heavy earth moving equipment used in open pit operations lasts far longer and requires fewer replacement parts when wearing surfaces are hard-faced with Stoody alloys. The illustrations show typical examples of both manual and semi-automatic applications. For top welding speed—2 to 4 times faster than manual welding—use Stoody semi-automatic tubular alloy wires... to speed maintenance during short down periods and between shifts, to save time and cut over-all costs.

Ask your Stoody dealer for a free copy of the Stoody Guidebook and the Semi-Automatic Wire folder; this literature covers hard-facing recommendations for all types of heavy equipment. Check the "Yellow Pages" of your phone book for local distributors—or write direct.

Shovel teeth *are first hard-faced as shown with Stoody 100 by the semi-automatic welder. Points are touched up manually during lunch time and at end of shift with 3/16" Stoody Coated Electric Tube Borium.*



Cutters and sides of scrapers *are subject to severe wear. Semi-automatic application of Stoody 100 provides protection.*

Parallel beads *of Stoody 100 are run along bed of dump trucks to reduce wear in these areas. Material packs between beads, further reducing wear.*

Ripper teeth *have wearing surfaces hard-faced semi-automatically with Stoody 100. 1 or 2 beads of Tube Borium hold points to size.*

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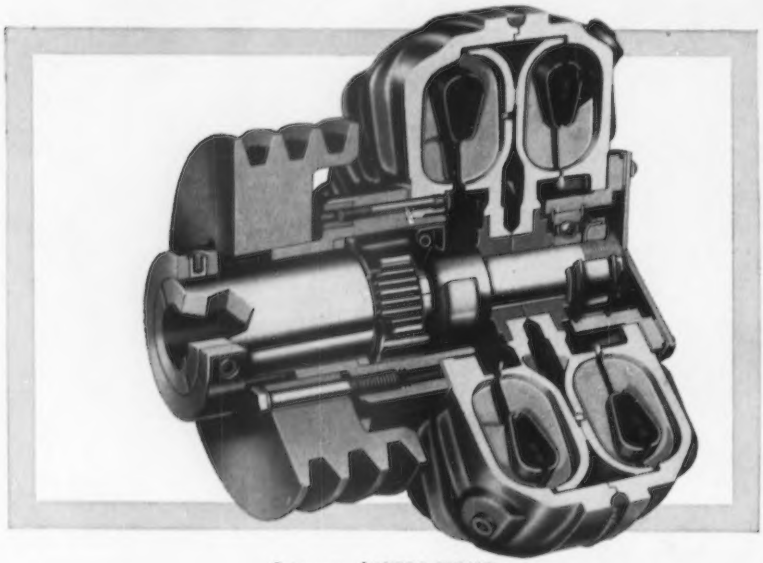

Cut-away of HYDRO-SHEAVE

Wherever you find shock loads, torsional stresses or vibrations, you can bet both driving and driven equipment will show undue wear.

That is, *unless the power is transmitted through fluid!*

With Twin Disc Fluid Couplings and HYDRO-SHEAVE® Drives, there are no mechanical connections between driving and driven equipment . . . no metal-to-metal contact to transmit destructive shocks and vibrations. These, instead, are absorbed in the fluid—not in your machinery's expensive components.

But that's not all. Twin Disc Fluid Couplings and HYDRO-SHEAVE Drives offer such advantages as—

1. **Reduce motor starting current demands . . . provide smooth, fast acceleration . . . and often improve over-all power factor.**
2. **Protect against overloads, stalling and motor burn-outs.**
3. **Transmit full input torque at all output speeds.**
4. **Permit motor selection based on running rather than starting load.**
5. **Are engineered as a "package" . . . can be installed in minutes on any standard keyed shaft.**
6. **Because of fluid connection, *cannot* wedge or "freeze" internally.**

Twin Disc HYDRO-SHEAVE Drives—¾ to 50 horsepower; Fluid Couplings—¾ to 850 horsepower.

TWIN DISC

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case history

Location: Michigan plant of a well-known iron ore processor.

Equipment: A 30-inch iron ore conveyor.

Application: Carries iron ore from stockpile to processing location.

Problem: Starting a conveyor of this type normally imposes a high and lengthy starting current draw on the motor. In this case, starting the conveyor caused very undesirable voltage fluctuation throughout the electrical system.

Solution: A Twin Disc 14.5 Fluid Coupling was installed between the conveyor motor and the speed reducer driving the conveyor.

Observed Results: The Twin Disc Fluid Coupling permits starting the conveyor with no difficulty, regardless of how heavily the conveyor is loaded. The Fluid Coupling permits the motor to come up to speed immediately, while the load is picked up smoothly and gradually. This also protects other electrical components on the line because the peak starting current draw is virtually instantaneous . . . thus low-voltage trips and circuit breakers are not actuated.

This is another factual report on how industry profits through the use of Twin Disc Fluid Drives. For complete information, write Twin Disc Clutch Company, Racine, Wis.

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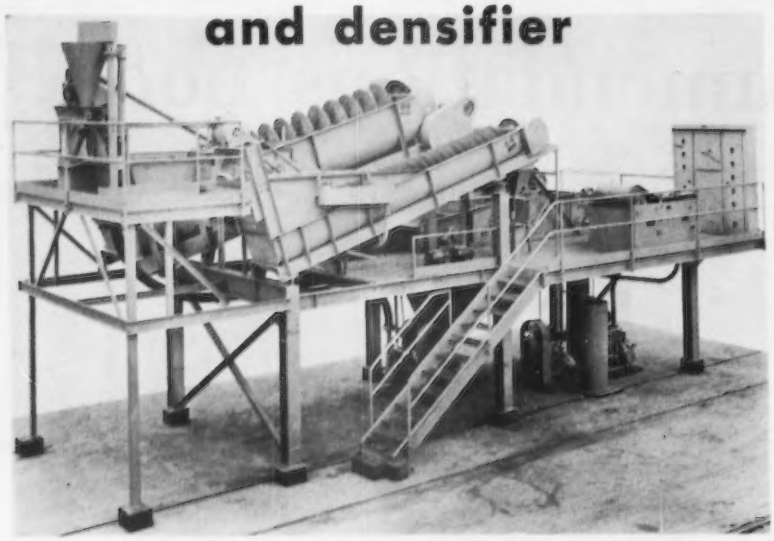

Typical Akins 3-product HMS installation with Separator and Densifier. Note how Akins tank construction permits simple supporting structure. These Sweco-built plants are compact, simple in design, and convenient.

designed, manufactured, erected by Sweco

These prefabricated HMS plants are designed, manufactured and erected by the Southwestern Engineering Co., Los Angeles. Akins Separators were selected by Sweco because . . .

Media discharge end of Akins Densifier showing demagnetizing coil.

EXPERIENCE has proved these advantages of Akins

- Gradation of pool density from feed entry point to sink removal point provides natural cleaning of sink, and allows circulation of media at lower gravity and viscosity.
- Gradation of pool density also allows 3-product separation in one machine. Extraction of middlings requires only one media cleaning circuit.
- Start-up under full load, eliminates necessity of draining vessel after shutdowns.
- Variation in rate or grade of feed is not detrimental.
- Large pool area depth and volume minimize tramp refuse in the product and facilitate better recovery of values from fine sizes.

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B.C. (*Continued*)

partment of National Defense.

Cost of the 50 miles of bituminous surfacing will be about $2-million, with the work to approximate construction standards of the Trans-Canada highway now being built across the country.

Built during wartime for defense without regard to economic location, the road during postwar years has become one of the most important facilities in development of mineralized areas in the Canadian Northwest Territories. Recently it has provided access for several crude oil and natural gas discoveries in northeastern British Columbia.

Canadian government henceforth will pay 50% of the cost of building airstrips for mining operations opening up in the Northwest Territories, it has been announced by the Department of Northern Affairs, which has jurisdiction over the area.

The federal cabinet decision was embodied in an order in council of May 3 confirming the 50% arrangement with respect to air strips at Consolidated Discovery Yellowknife Gold Mines and the newly reopened Taurcanis Gold Mines, both in the Yellowknife area.

The aid for air strips is an extension of federal government policy which pays 50% of the cost of road construction in new areas.

The Alberta and Northwest Chamber of Mines and Resources reports that Rayrock Mine, 60 miles north of Yellowknife, is scheduled to become the Northwest Territories' second uranium producer in June.

The Chamber stated that J. C. Byrne, Rayrock president, has reported that drifting on the newly opened 500-ft level has exposed a sizeable body of high grade ore which will increase the previously estimated $9-million reserve.

All heavy machinery for the mill has been delivered at the mine site and installation work is well advanced. When the mill goes into operation in June it will handle approximately 150 tpd ore. Ore yield averages 13.5 lb of uranium oxide per ton.

The Chamber reported that uranium production of Gunnar Mines Ltd. "will rise sharply with the advent of warmer weather and it is expected the mill will exceed its 1,650-ton rating by fall when underground mining will get under way."

"It is expected," said the Chamber, "that Gunnar will reach a production rate of $20-million per year before the end of 1957."

The Chamber reported further:

North Rankin Nickel Mines on Rankin Inlet, estimates 1957 production at between 6,000 and 10,000 tons of nickel concentrates..

Consolidated Discovery Yellowknife Mines predicts a total 1957 production of 80,000 oz of gold from 50,000 tons of milled ore.

American Smelting and Refining Co. has decided to increase the rate of exploration of copper ore zones on Bethlehem Copper Corp. Ltd.

why "unit assembly" construction adds up to MORE TRIPS PER HOUR

Your choice of an Ingersoll-Rand double or triple drum Scraper Hoist . . . either air or electric . . . adds up to *more* trips per hour, less maintenance and longer hoist life. Each unit consists of its own barrel-type housing, rope drum, gearing and clutch which operate independently. This means you can select the right combination of pulling power and speed. It also means that return rope speeds are at least ⅓ faster than pull rope speeds.

Selection of the right scraper hoist for your job is easy when you choose from the wide range of "Unit Assembly Hoists". Write for Bulletin 5300A. Engineering help on your scraper mucking problems is available for the asking—no obligation.

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SAVES UP TO $162 PER WEEK

Amsco® Semi-automatic S/A-53 Tube Rod... used in place of a competitive semi-automatic rod, is saving a large sand and gravel operator up to $162 per week on roll crusher hardfacing. And this is done with no loss of service life . . . no increase in welding time or rod consumption.

These roll crushers handle 3000 tons of gravel per week, work 10 days between hardfacings. Replacement rolls are hardfaced daily, using about 50 lbs. of rod.

You can make comparable savings by using Amsco S/A-53 Tube Rod in severe impact-abrasion service. S/A-53 is designed especially for use with Amsco MF Semi-automatic Welders, but other machines may be easily adapted to accommodate its $^3/_{32}$" diameter.

S/A-53 is a prehardened, pre-lubricated, high-chromium alloy rod . . . easy to weld on carbon or manganese steel. Deposits from 5 to 15 lbs./hr. according to current settings. Deposit hardness averages 425 to 475 Brinell.

Any Amsco Distributor will give you a chance to try S/A-53 in an Amsco MF Semi-automatic Welder. Why not take him up on it and test the savings yourself?

Write for Bulletin 656, describing S/A-53 and the complete Amsco "wear-fighter" welding line in detail. Address: Amsco Welding Products Department, Chicago Heights, Ill.

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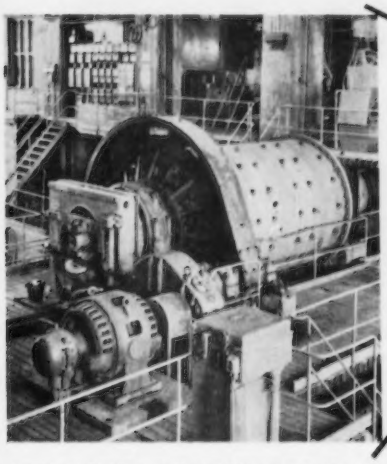

An 8' x 12' Marcy Rod Mill on copper-lead-zinc ore at the A. B. Zinkgruvor mill in Garpenberg, Sweden. This mill is just one of approximately 35 Marcys made by Mine and Smelter's licensed manufacturer and sales representative in Scandinavia, Morgardshammars Mekaniska Verkstad, Morgardshammar, Sweden...a company with an international reputation in the mining industry for over 100 years.

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For more than 40 years Mine & Smelter has specialized in the design and manufacture of grinding mills. This *experience* has resulted in a selection of materials and a type of construction which assure long, trouble-free operating service, minimum maintenance, and maximum convenience in installing, aligning, and operating the mill.

It is equally important to you to have available good manufacturing and service facilities, as provided by our U.S. plant . . . and our foreign manufacturers and representatives, who are experienced mining people backed by excellent shop facilities. You can depend on them to do a good job.

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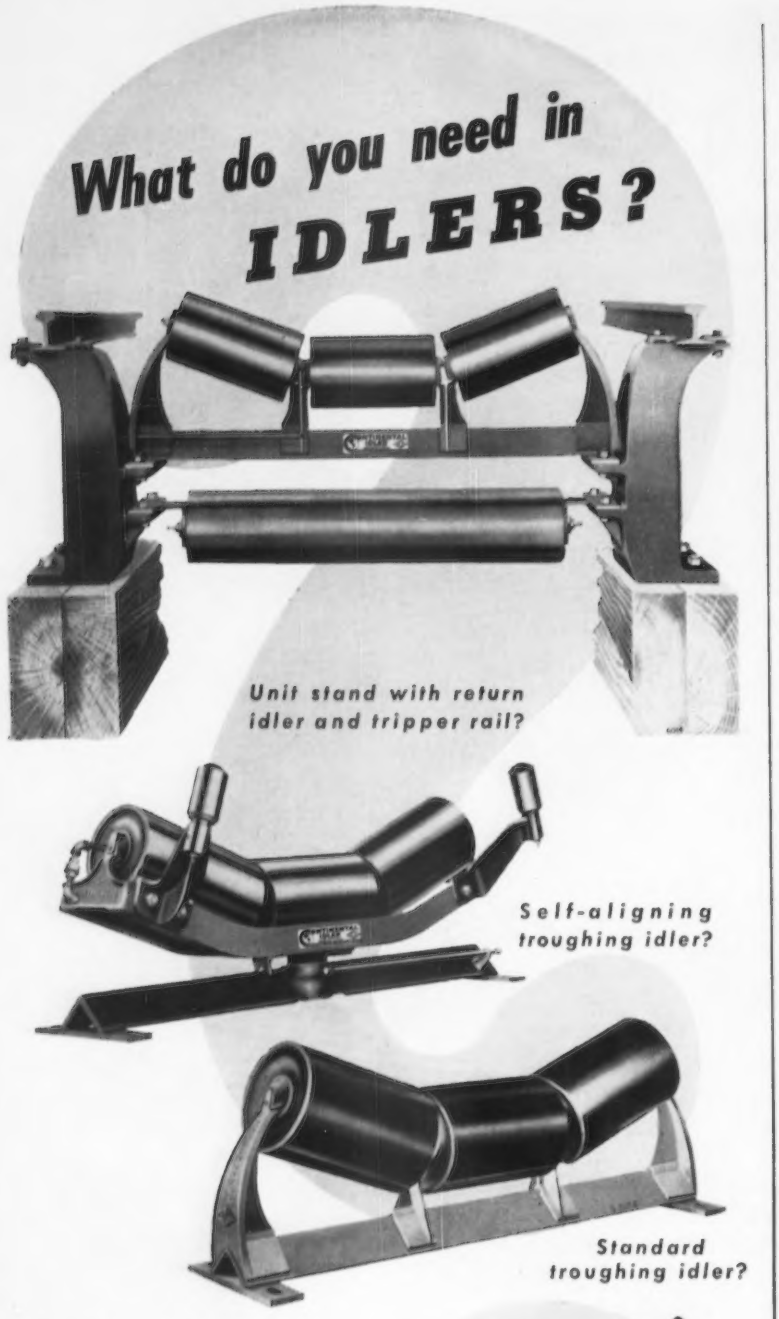
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CGC ATLANTA CLEVELAND DALLAS KNOXVILLE MEMPHIS MOBILE NEW YORK 17

B.C. *(Continued)*

Monthly expenditure will be stepped up from $50,000 to $60,000 and AS&R will spend a total of $305,000 on Bethlehem's original Highland Valley property from May 1 to October 1. This follows a $300,000 program over the past six months.

The new program will include 10,200 ft of additional diamond drilling, about 10,000 ft of churn drilling, geological and geophysical surveying, and comprehensive metallurgical tests.

Galkeno Mines is operating the Keno Hill, Yukon, mill at a rate of 130 tpd, and ore reserves are being increased monthly, annual report states. (Milling was resumed on a 120-tpd basis on July 1, 1956.) By February, reserves were increased to 61,399 tons averaging 36.1 oz silver and 8% each lead and zinc.

Consolidated Mining and Smelting Co. has announced it is considering a $5-million mill at Kimberley to produce pig iron and steel from the pyrrhotite tailings at the Sullivan Mine.

The plan would use the latest electric furnace smelting methods. Plant design now is under way to obtain capital and operating cost estimates. Research is expected to take about a year.

At least a million tons of 50% pure iron ore is reported to have been outlined by an Edmonton company along the northern British Columbia-Alberta border.

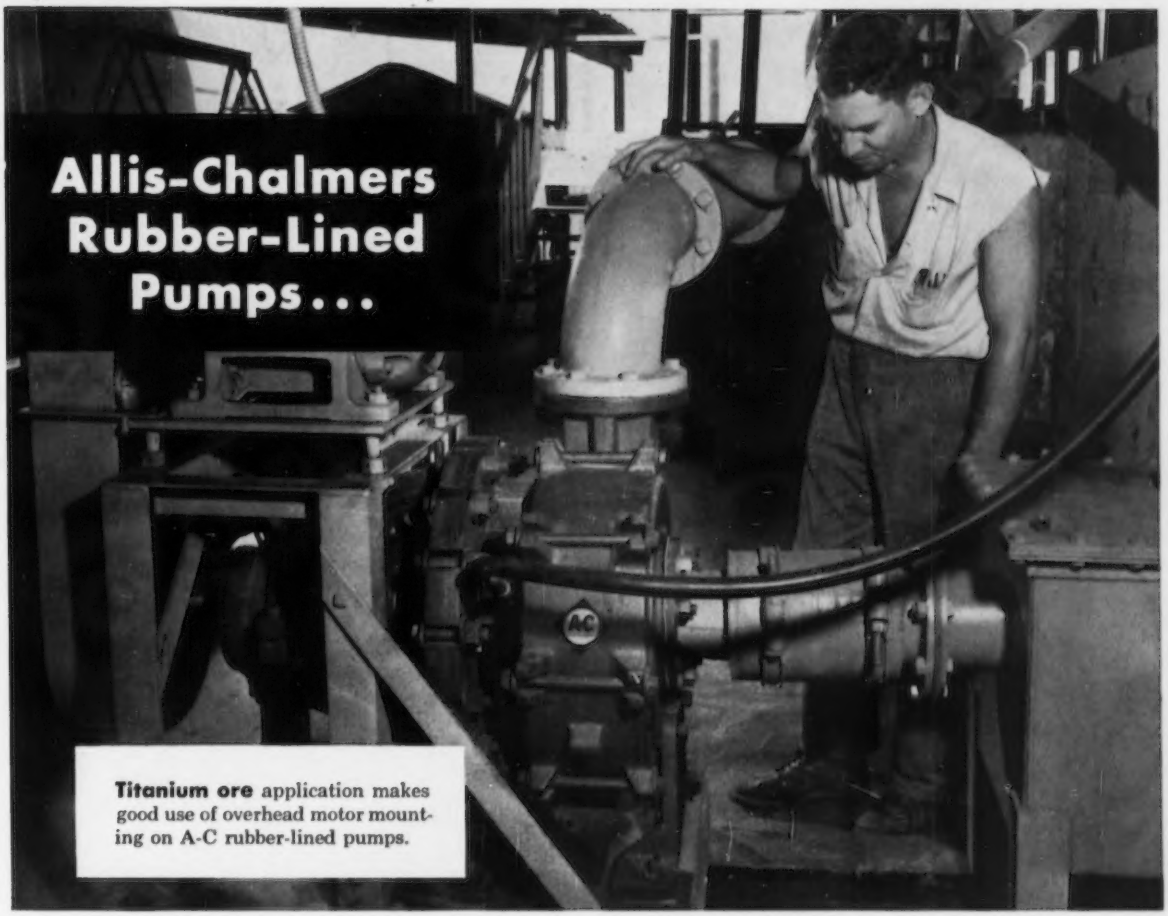
Premier Steel Co. Ltd. has extensive leases on property in the area and is prospecting and making economic studies of the entire long-range project located near Hine's Creek, Alberta, northeast of Fort St. John, B.C., present projected railhead of the Pacific Great Eastern Railway.

IN LATIN AMERICA

DOMINICAN REPUBLIC

Five mineral concessions, totaling approximately 12,000 hectares, have been granted for a 30-year period beginning January 16, 1955, to the Minera Beneficiadora Dominicana, C. por A. This company was organized by William D. Pawley, with participation by United States and Canadian interests including Vernon J. Pick of uranium fame, and officials of the Falconbridge Nickel Co. of Canada. Company was incorporated in the Dominican Republic on October 1, 1955.

Minerals specifically listed in the concession authorizations are nickel, chromium, cobalt, iron, copper, molybdenum, silver, gold, lead, zinc, tin, uranium, sulphur, and manganese, but they also authorize exploitation of any other metal encountered in the concession areas. The concession authorizations provide that



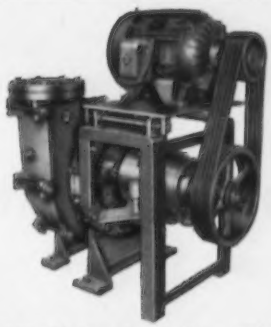
Titanium ore application makes good use of overhead motor mounting on A-C rubber-lined pumps.

Resist abrasive wear

TEN to 50 times greater abrasive service life has been proven in Allis-Chalmers rubber-lined pumps than in expensive alloy pumps. Here's why:

- Special rubber compounds resist wear of even such abrasive slurries as taconite and silicon carbide.
- Casing liners are pressure molded to steel frames, combining the rigidity of steel with the resilience of rubber.
- Slotted bolting simplifies parting casing for inspection of impeller and liners.
- Extra heavy duty oil-lubricated bearings to overcome the thrust encountered in continuous demanding operation.

Among the many features available with A-C rubber-lined pumps is overhead motor base mounting. With this arrangement, water and muck can't reach vital motor parts. Contact your A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.



Complete pumping unit is offered by Allis-Chalmers: includes pump, motor, *Texrope* drive and control.

Texrope is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-5401

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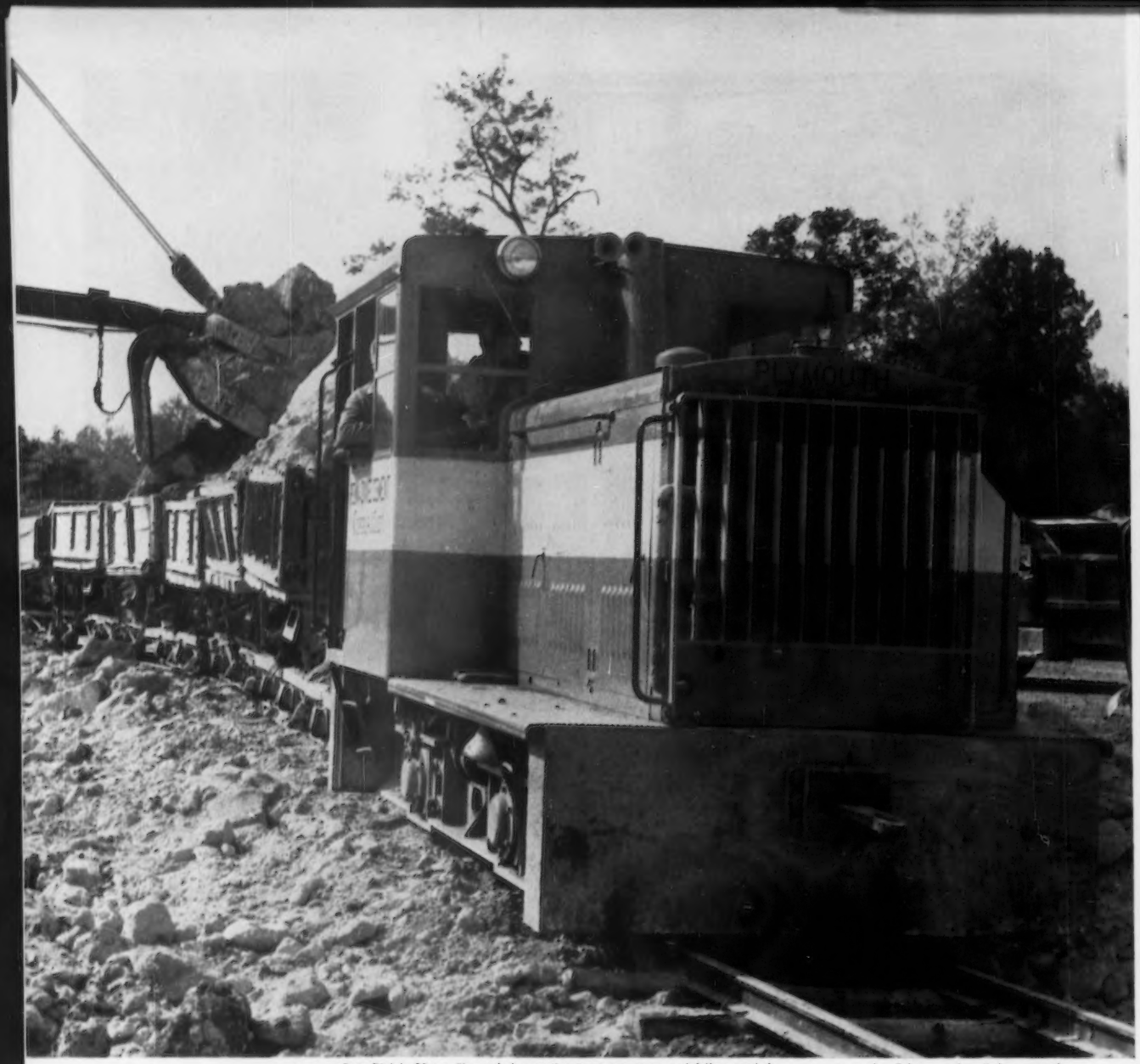

Penn-Dixie's 20-ton Plymouth Locomotive transports stone and fullers earth from quarry to crusher 8 hours a day, 5 days a week.

"Fuel savings alone amount to over $2600 a year"

Here's real economy in haulage operations: "We like our Plymouth very much . . . it is definitely faster, more efficient than the steam locomotive we used formerly," states B. B. Nall, superintendent of Penn-Dixie Cement Corp., Clinchfield, Georgia, in describing the performance of the company's 20-ton Plymouth Diesel with Torqomotive Drive.

"Over a ¾-mile route from quarry to crusher, our Plymouth Diesel saves us more than $10-per-day in fuel costs alone. Maintenance costs have been exceptionally low with a minimum of down-time in more than three years of continuous operation."

Plymouth's high operating efficiency and low operating cost make hauling, switching and spotting jobs more profitable for large and small companies everywhere. Whether your requirements call for gasoline or Diesel power, mechanical or torque-converter drive, we will gladly send you complete information on a Plymouth built specifically to meet your haulage needs. Send a brief outline of *your operations* to: The Fate-Root-Heath Company, Dept. A-22 Plymouth, Ohio.

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Carbon steel formerly used in this Simplicity aggregate drier wore out from smashing impact after handling 1¼ million tons of crushed dolomite but life expectancy is now over 4 million tons. Drier operates in one of the plants of The J. E. Baker Co.

Lukens "T-1" steel triples life of rock drier

TRADEMARK

Are impact and abrasion shortening the life and rocketing the costs of your equipment? If so, there's a lesson here for you:

When the liner shell and partition plates of this 10 x 20 foot Simplicity aggregate drier were replaced with Lukens "T-1" steel, life expectancy increased threefold!

Whether you handle stone, coal, or metal ores, it will pay you to investigate Lukens "T-1" steel for surfaces hard-hit by impact and abrasion. The 321 minimum Brinell quality has been known to outlast ordinary steels by 18 to 1. Applications are many throughout the materials handling and processing industries. Wear plates, chutes, hoppers, and mine cars are typical.

The remarkable combination of hardness and toughness in this high yield strength, readily welded alloy steel is even maintained at temperatures well below zero. *Send for informative illustrated booklet, "Lukens 'T-1' Steel." Write Manager, Marketing Service, Room 901, Lukens Steel Company, Coatesville, Pennsylvania.*

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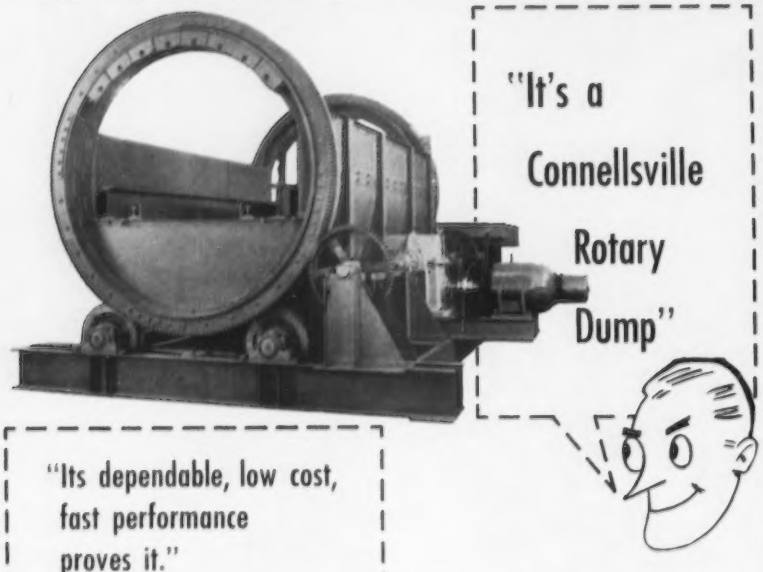
FOR THE MINING INDUSTRY



● Performance experience clearly shows the utter dependability and efficiency of custom designed Connellsville Rotary Car Dumpers. Users are familiar and pleased with their sturdy build, low upkeep and long life.

● Available in the complete revolution type or the 180° and return type, Connellsville Dumps are friction, traction, rope, chain or gear driven.

● All units are counterweighted in proportion to the car and live load to be handled. This feature, by introducing a "free" assist in returning the empty car to an upright position, reduces horsepower requirements and cuts power costs.

● Interlocking arrangement between the Dump controls and car hauls permits complete control of the loaded cars at all times.

● Speedy 10 second dumping cycle is set in motion automatically or by push button with cars coupled or uncoupled.

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"SERVING THE MINING INDUSTRY SINCE 1901"

Dom. Rep. (*Continued*)

the State or its dependencies will receive as taxes, duties, and other charges 5 per cent of the net profit of the enterprise during the first 5 years following the effective date of the concession and for each 5 years thereafter will receive an additional increase of 5 per cent of the net profit, which cannot exceed 30 per cent. The above provisions apply only to minerals that are processed before exportation from the Dominican Republic. Such minerals as may be exported in their natural state will be subject to special provisions established for each particular case.

Company will be exonerated from customs and other import duties on machinery and equipment imported for use in the enterprise. It will also be exempt from export duties on the minerals produced and on machinery and equipment previously imported for its use.

While some time may elapse before any significant quantities of minerals are exploited by the company, there is a strong possibility that its operations may eventually lead to a marked increase in Dominican mineral production and exports.

MEXICO

Nearly 100,000 tons of sulphur were produced during April. More than half of this—55,000 short tons—was produced by Pan American Sulphur Co. at Jaltipan. Total includes production from Texas Gulf's affiliate which has a barge-mounted Frasch plant at Nopalapa; Gulf Sulphur's operation at Salinas, and Petroleos Mexicanos' sour gas extraction plant at Poza Rica. All installations are in the State of Veracruz.

Total does not include any contribution from Mexican Gulf Sulphur, which ceased production late in March after having produced only about 158,000 tons of sulphur since it began operation in mid-March, 1954. Mexsul is now drilling wells under contract on a nearby concession for Central Minera, affiliate of Texas International. If commercial deposits of sulphur are found on Central Minera's concession, an arrangement is expected to be worked out whereby Mexsul's plant may be used for extraction.

Harry C. Webb, president, Pan American Sulphur Co. made the following three-month report to stockholders:

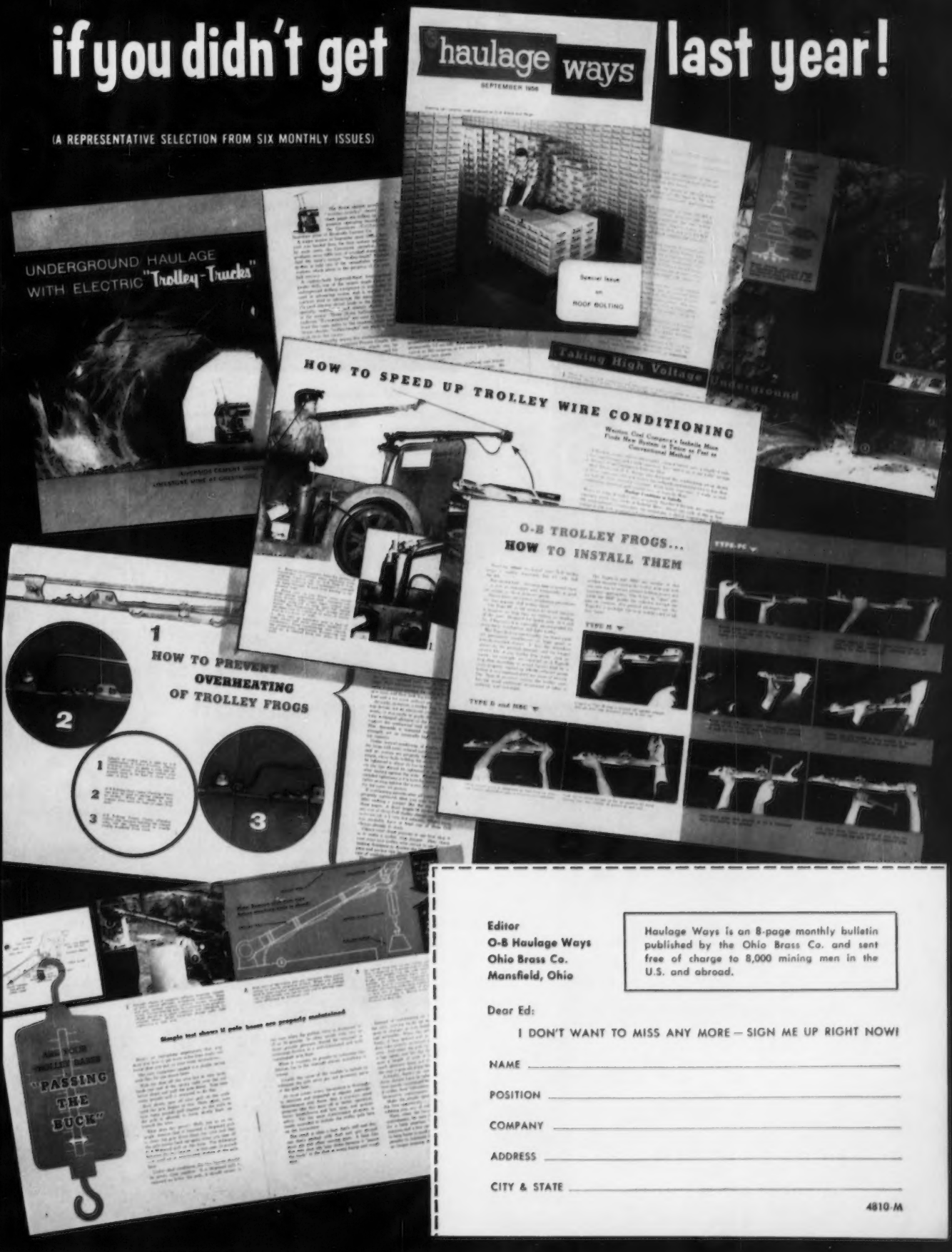
"Shipments in the first three months of this year totaled 141,000 long tons—a 130 per cent increase over the amount of sulphur we shipped out in the same period last year.

"Other recent developments which will further strengthen your company's position in the industry will also be of interest to you. Your company has started a stockpiling program in Tampa, Florida, to better serve our customers in that area, and to offer greater over-all flexibility to the company's general marketing program. The first shipment has already arrived, and it is planned to stockpile anywhere from 15,000 to 45,000 gross tons, depending on customer require-

HERE ARE JUST A FEW OF THE ARTICLES YOU MISSED

if you didn't get haulage ways last year!

(A REPRESENTATIVE SELECTION FROM SIX MONTHLY ISSUES)



Editor
O-B Haulage Ways
Ohio Brass Co.
Mansfield, Ohio

Haulage Ways is an 8-page monthly bulletin published by the Ohio Brass Co. and sent free of charge to 8,000 mining men in the U.S. and abroad.

Dear Ed:

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Experienced Honeywell application engineers know your industry and processes. They design *complete* systems of instrumentation, reducing the work of your own engineering staff. From the broad Honeywell line, they recommend instruments that are exactly right for the job. And because Honeywell supplies all types of instruments, recommendations are made without bias. Service engineers will, if needed, help with installation and startup of your system.

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The tuition-free Honeywell Training School teaches your instrument technicians the most up-to-date maintenance methods, fits them for the kind of problems they may encounter on the job. Intensive courses range from two to fourteen weeks.

Honeywell offers you far more than instruments. You get service whenever and wherever you need it . . . service that begins when you first decide you need instruments, and continues long after they're installed. This service is always conveniently close at hand, for there are more than 110 Honeywell sales and service centers located strategically throughout the U. S. and Canada.

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Follower rod disappears after filling—for ease of handling!

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Mexico (*Continued*)

ments, and to retain this amount at all times for ready pickup. We are confident that this program will be of extreme value to your company and result in additional business.

"New sales contracts have been consummated during the past month representing an additional 120,000 gross tons annually. Over and above the greatly improved sales results in the first quarter of this year, this additional volume indicated for the future offers further assurance of continued company growth.

"In order to prepare ourselves for the increased shipments anticipated over the long term we have started construction of a second loading facility, at Coatzacoalcos, Veracruz, Mexico. This project was referred to in the annual report and, when completed, this new facility will bring our export shipping capacity to 1,500,000 tons annually."

CUBA

Cuba's first copper fabricating plant was formally opened by its joint owners, Banco de Fomento Agricola e Industrial de Cuba (Banfaic), Holland Insulated Wire & Cable Works, Ltd. (Draka), Amsterdam, and Phelps Dodge Corporation, New York.

President of the new company, Productos de Cobre de Cuba PhelDrak, S.A., is Howard T. Brinton, head of Phelps Dodge's fabricating subsidiary, Phelps Dodge Copper Products Corp. New plant is located near San Jose de Las Lajas, about 30 miles from Havana, and will manufacture various types of copper wire and cable.

Brinton said the new copper concern already had received large initial orders.

CHILE

Last year the medium size and small iron mines which started operating about 3 years ago exported 1,415,626 metric tons of high grade iron ore (above 60% Fe) to the U. S. (977,450 tons) West Germany (288,260 tons) Canada, Japan, Belgium and Holland. In this total is not included the ore shipped to Sparrows Point by Bethlehem from its new iron deposit of El Romeral, Coquimbo.

Three American companies operating in Chile last year bought in this country 8,690,000 Chilean pesos ($15-million) worth of supplies against 3,200-million pesos in 1955.

Mr. Clyde E. Weed, president, Anaconda Co. was decorated by Chile with the Order al Mérito Bernardo O'Higgins for distinguished services rendered to the country. Decoration was presented to Mr. Weed in a special ceremony held in the Chilean chancelorship.

Mr. Weed on returning to Santiago after an inspecting visit to Chuquicamata (Chile Expl. Co.); Potrerillos (Andes Copper Mining Co.) and the new copper deposit of El Salvador, said in a press conference that Anaconda had great faith in the future of the copper market.

He also mentioned the fact that the output of Anaconda's Chilean subsidiaries will increase in 1959 by 75,000 tons per year when El Salvador, whose reserves are already greater than 300-million tons, 1.6% Cu, starts producing.

Mr. Harry F. Guggenheim, president, Anglo-Lautaro Nitrate Co., mentioned in a press conference before departing for the States that his company will spend in his nitrate mines and plants $25-million of which 16 will be loaned by Eximbank. This large sum will be invested chiefly in improving mining equipment and enlarging the solar evaporating units of the plants.

Bethlehem Chile Iron Mines will soon start constructing a 6,000-tpd mill to beneficiate the low grade ore left at El Tofo mine. The ore only requires crushing to about 2 in. to concentrate by gravity and magnetic methods. Cía. Minera Santa Bárbara will also build a 4,000 tons a day mill to treat the lower grade iron ores from its mines. Santa Bárbara owns a few middle size iron mines in Coquimbo and Atacama provinces.

Cía. Minera Tamaya has successfully started its 80-tpd pyritic smelter at Las

TRIANGLE BRAND
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For more than fifty years TRIANGLE BRAND COPPER SULPHATE has been the accepted activator for the removal of sphalerite from lead-zinc ores. It is 99% + pure and available in several sizes to meet your requirements.
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These are five of many reasons why Allis-Chalmers FORTY FIVE motor graders are showing up in more and more mining and quarrying operations. They are precisely what the dirt-moving specialists ordered . . . ready now to handle haul road construction and maintenance easily, smoothly. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

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THE NEW GARDNER-DENVER
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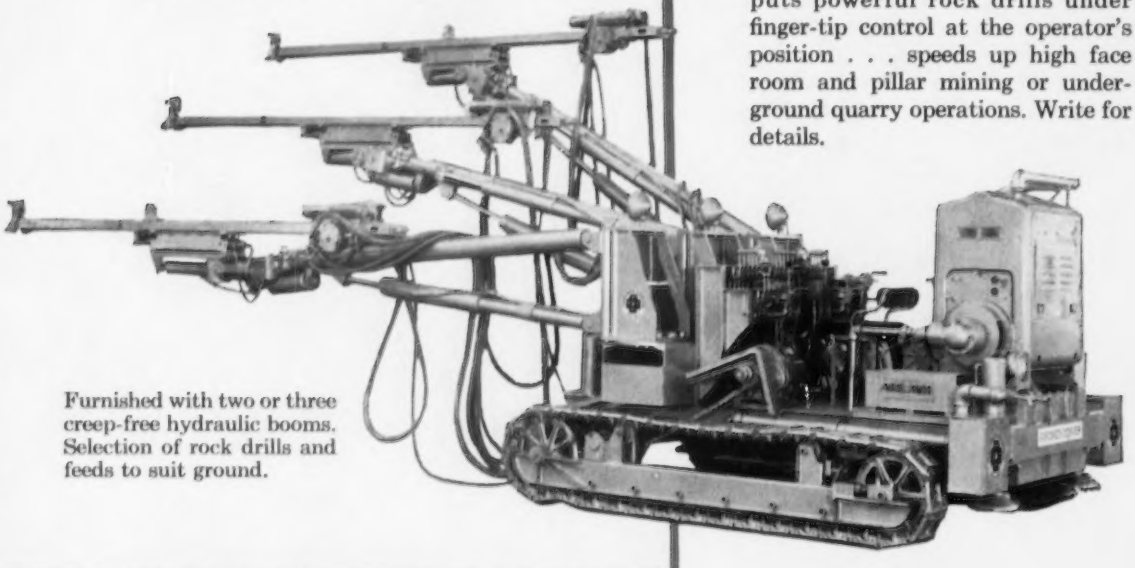
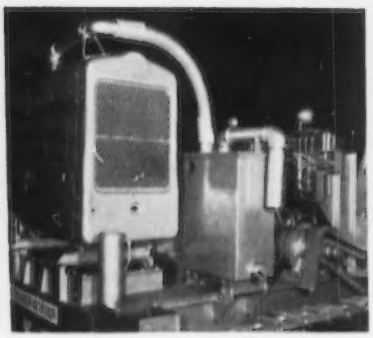
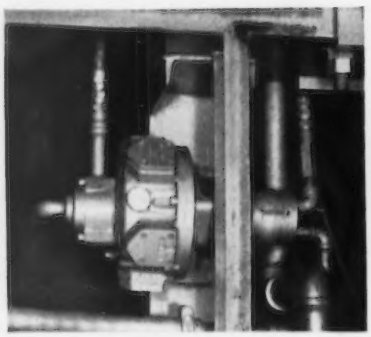
"Push-button" rock drilling with the new Gardner-Denver JMT "MOBILJUMBO" offers new opportunities to increase productivity with less effort. The new JMT self-propelled, crawler-mounted jumbo puts powerful rock drills under finger-tip control at the operator's position . . . speeds up high face room and pillar mining or underground quarry operations. Write for details.



Furnished with two or three creep-free hydraulic booms. Selection of rock drills and feeds to suit ground.



Available with diesel-hydraulic drive to the crawlers, or with crawlers powered by 5-cylinder radial air motors.



Air motor drives hydraulic pump for remote hydraulic control of boom and drill positioning by one man.

Electric generator, air motor driven, supplies three lights that flood working face, light drilling operations.

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Chile *(Continued)*

Chivas mine at Aisén Province in southern Chile. Las Chivas is a high grade, 14%, massive pyrrhotite-chalcopyrite deposit on the shores of Buenos Aires Lake. At the present time only a matte of 40% grade is being produced at the Mace blast furnace, the converters not being ready as yet.

Cía. Minera Tamaya is also operating at full capacity now its 400-tpd flotation mill at the famous old Tamaya copper camp. At the present time the mill is treating only 2% copper ore from dumps and fills but development campaign is being carried out in the mines to find virgin ore at the Lecaras adit level. Tamaya is also cyaniding gold ores and flotation its Au-Hg-Cu ores at its 200-tpd mill at Punitaqui. Both the Tamaya and Punitaqui operations are located in Coquimbo Province.

IN THE PHILIPPINES

Mindanao Mother Lode Mines has found it difficult to operate its copper mine profitably in Zambales because of the drastic decline in the copper price. Tonnage to the mill cannot at present be increased sufficiently to compensate for the lower value of the ore. It is expected this can be rectified by developing more working faces, as well as by securing ore for milling from other nearby properties on a custom basis.

Three Japanese steel mills will join in developing the Sibuguey iron ore deposit in Mindanao. Development will require several years with expenditure of $5-million. Japanese engineers will assist in the work, with ore to be consigned to Japan. Estimated future production will be at an annual rate of 1-million tons.

Gold continues to sell in the Manila open market for 125 pesos an ounce ($62.50 at the official exchange rate.) Producers are clamoring for further relief and want an extension of the government subsidy program due to expire on June 30. It is emphasized that operating expenses have risen from 5 to 10 pesos per ounce since 1954 when the subsidy first went into effect. Under the present subsidy program about 75% of newly mined gold is acquired by the Central Bank, with the other 25% sold to holders of blocked peso funds who can in turn sell this bullion to the bank for dollars at the statutory rate and thereby obtain dollars to take out frozen funds.

IN AUSTRALIA

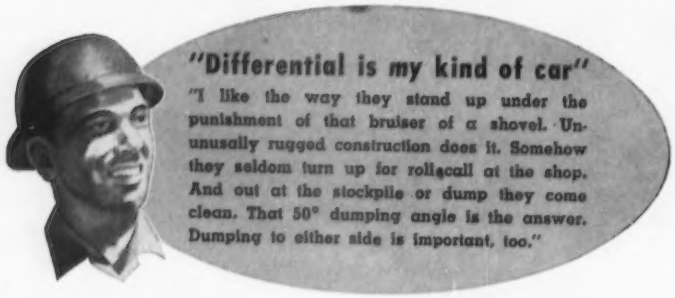
Mr. G. R. Fisher, Chairman of Mount Isa Mines Ltd. has announced the discovery by a Mount Isa Mines Ltd. geological survey party of an outcrop containing lead carbonates, seven miles northwest from the McArthur River Homestead and 33 miles southwest from Booroloola in the Northern Territory, and 400 air miles northwest of Mount Isa.

Outcrop has now been delineated by surface trenches and is approximately 400 ft long with an average width of 120 ft, containing approximately 10% lead. A prospecting shaft has been sunk to 60 ft and a crosscut from the bottom of the shaft advanced 70 ft in similar grade material. Sinking of additional prospecting shafts and crosscutting will be continued to delineate the mineralization at the 60 ft horizon.

Work is being continued through the wet season, but is limited because equipment cannot be transported by road to the location which is in an almost unpopulated area.

Continuing heavy demand for ilmenite of Australian origin is forcing a complete re-examination of production targets and a large-scale expansion of production facilities is contemplated.

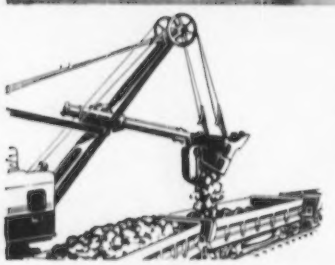
Western Titanium N.L., one of the largest producers, has just announced immediate start of work on a 50% increase in capacity. Same company will also purchase and install secondary treatment plant for monazite, rutile and zir-


"Differential is my kind of car"
"I like the way they stand up under the punishment of that bruiser of a shovel. Unusually rugged construction does it. Somehow they seldom turn up for rollcall at the shop. And out at the stockpile or dump they come clean. That 50° dumping angle is the answer. Dumping to either side is important, too."

This kind of talk from an increasing number of users is convincing. For nearly 40 years Differential Haulage Equipment has been doing a pace-setting job.

If you would like facts and figures to meet your needs, just write or call our Findlay office. You'll get prompt, expert help with your haulage problems, large or small.

DIFFERENTIAL PRODUCTS INCLUDE:
Air Dump Cars, Charging Box Cars, Ingot Mold Cars; Locomotives, Mine Cars, Mine Supply Cars, Rock Larries, Mantrip Cars, Dumping Devices and Complete Haulage Systems.



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NEW, 2-YD LOADER steps up efficiency of this operation

TRACTOMOTIVE TL-20D TRACTO-LOADER® Takes Over The Ore Loading Job — Releases Clamshell For Other Duties. Speeds Other Loading and Stockpiling in Rock Quarry for Basic Refractories., Inc., Fostoria, Ohio.

TL-20D LOADS 13 TONS OF HEAVY PHILIPPINE ORE IN 3 PASSES (material used in manufacture of brick). A rail-type clamshell was tied down full-time to this part-time job. Now the clamshell is used on other work . . . and the versatile TL-20D easily handles the ore loading, among its other jobs.

ON STOCKPILING, the TL-20D carries over 7,000 lb of limestone every trip up a steep incline. Delivers full loads because the TIP-BACK bucket retains the loads. Stockpile is several hundred feet long, about 40-ft wide and nearly 40-ft high.

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Both the superintendent and operator are pleased with the stability and power of the TL-20D . . . the ease with which the hydraulic torque converter drive gets heaped loads . . . the speed and simplicity of one lever control of all speeds, forward and reverse — exclusive with Tractomotive. Operator shifts into and out of any gear, at will, "on the fly."

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The world of science behind
EXIDE-IRONCLAD BATTERIES

Being interviewed is Curtice C. White, Senior Development Engineer.

"These channels actually cool the battery"

At the Exide Laboratories—**Reporter:** First, Mr. White, tell me what makes a battery hot.

White: Heavy loads—they often raise battery temperature as much as 20 degrees.

Reporter: How do the channels cool it?

White: The heated electrolyte rises to the top through the channels. Plates are cooled by electrolyte coming up from the bottom.

Reporter: Don't all batteries have channels?

White: Unfortunately, no. It is the tubular construction of the Exide-Ironclad positive plate that leaves these channels on both sides.

Reporter: What does this feature mean in battery performance?

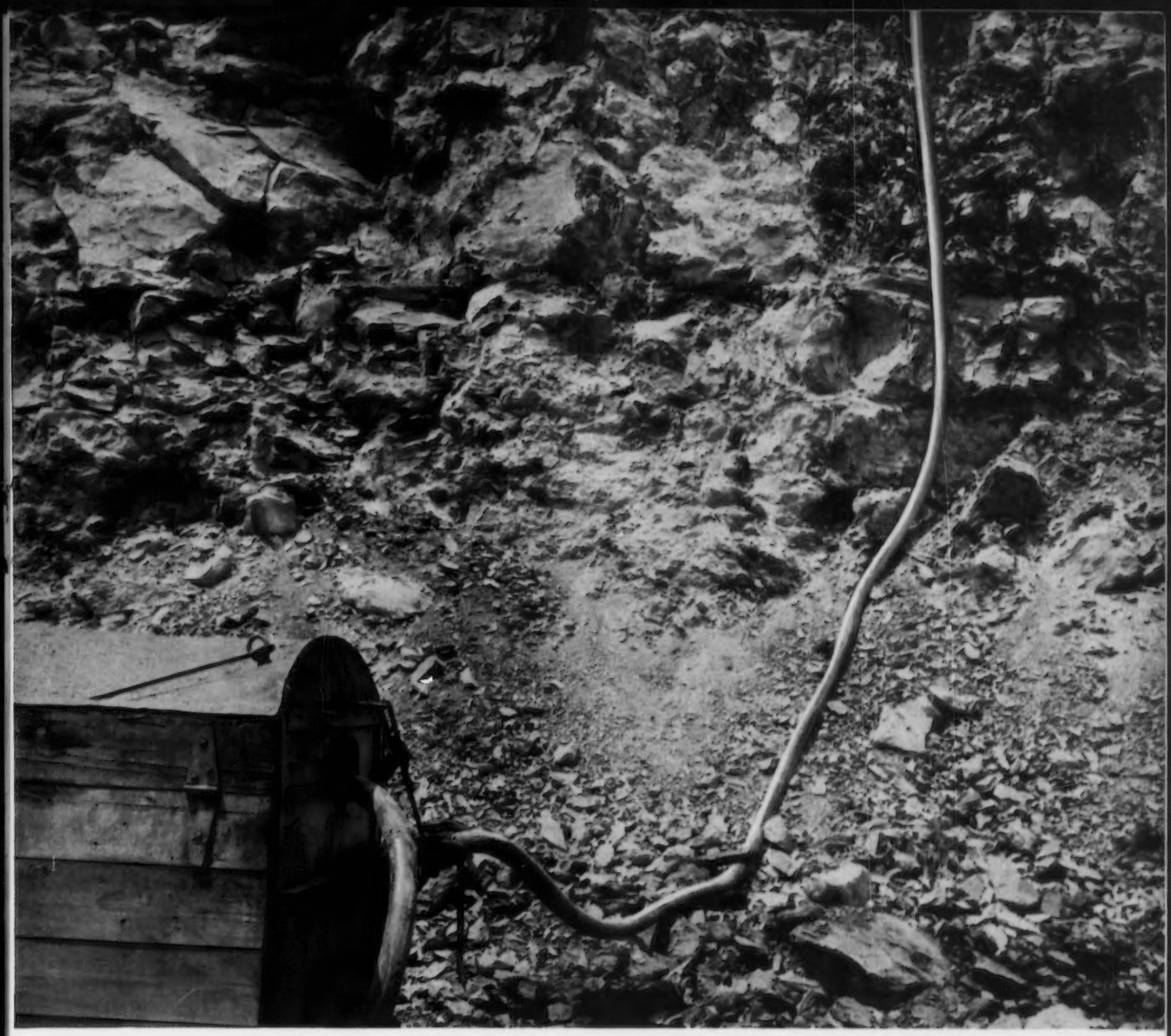
White: Longer battery life, for one thing. The battery stays cooler. Has less incidence of hot spots. Plates operate at a more uniform temperature.

Reporter: Obviously this is an important feature of Exide-Ironclad.

White: Yes it is, but it's just one of many engineering details that contribute to its high capacity and long life.

Note to battery users: Whenever you order heavy duty batteries or the equipment that requires them, be sure to specify Exide-Ironclad. For detailed bulletin, write Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide®**



60 ft. drop over rocky cliff—yet no power failure with Anaconda Mine Power Cable!

This cable is exposed to about as rugged a set of conditions as any cable is likely to meet. It has been pulled over sharp rocks . . . dropped over a 60 ft. cliff . . . and lies unprotected under sun and harsh weather day after day. Yet it has given unfailing service.

Why? Anaconda Mine Power Cable is designed and made by people who know *both* mining and cable engineering!

NEOPRENE JACKET is extra tough . . . has real flexibility and great strength. It resists abrasion, mechanical abuse, flame and water.

BUTYL INSULATION has superior long-aging characteristics . . . excellent resistance to ozone, heat and moisture. And it has high dielectric strength.

The Man from Anaconda or your Anaconda Distributor can give you full information about this durable, low-cost mine power cable. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

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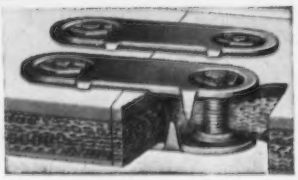
★ Distribute pull or tension uniformly.
★ Made of Steel, Monel, Stainless, Everdur. Also Promal top plates.
★ FLEXCO Rip Plates are for bridging soft spots and FLEXCO Fasteners for patching or joining clean straight rips.



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Built in single or double motor drives with double equalizers, drum or contactor type controllers, with or without dynamic braking, Greensburg Locomotives will haul more and cost less to operate!

Send us your haulage problem today!

GREENSBURG MACHINE CO. 102 STANTON ST. GREENSBURG, PA.

Australia (*Continued*)

con. It is reliably understood that a particularly high grade of monazite was struck with a high thorium and rare earths oxide content.

Australian ilmenite producers are working on a basis of £A6 per ton fob of ilmenite and current Australian production costs are about half of the selling price. Improvements in production and treatment methods, installation of new machinery and selling of monazite and zircon are expected to decrease current costs to a considerable extent.

Mine production of gold in Australia during 1956 was 1,031,000 fine oz, a drop of 18,000 fine oz from the 1955 figure and also lower than the 1954 and 1953 output figures. Western Australia continues to be the main producer with 78.9% of the Australian total with the Northern Territory in the second place with 7.3% and Queensland with 5.4%. Refinery production of 1,044,000 fine oz of newly-won gold of Australian origin was also lower than the comparable 1955 figure of 1,055,000 fine oz. Hong Kong continues to be the main export market of Australian gold producers.

South Australian Mines Department is meeting with increasing success in its exploratory and drilling operations in the search for iron ore. Several new areas, including at least two with serious indications of big body of high-grade ore, have been located. Some of them, however, appear to involve more expensive forms of mining operations.

At the same time it is understood that Australia's largest iron ore mining firm, Broken Hill Pty. Ltd. is making plans for switching a percentage of its production to Iron Baron, about 18 miles from Iron Knob. Big construction works are in progress at Iron Baron but it is understood that the rich Iron Monarch deposits at Iron Knob will continue to be operated though on a restricted scale. Millions more tons of high-grade iron ore are held under lease by Broken Hill Pty. Ltd. in the areas known as Iron Duke, Iron Duchess and Iron Knight, all of them in South Australia.

It appears the amount of ore proved so far in the South Alligator River uranium area falls below that required to fulfill the contract with the U. K. Atomic Energy Commission and to justify the erection of a treatment plant. If the U. K. order is not placed with the South Alligator companies, it will be given to Mary Kathleen Uranium. Additional order is expected to be in the vicinity of $45-million over the next decade.

Mt. Isa Mines Ltd. has introduced a Failing rig for exploratory drilling.

In its copper smelter a new achievement was recorded when three roasters went into action. In the lead smelter, fluid drives have been fitted to all sintering machines. In an area about 400 miles north-west of Mt. Isa, the company has discovered an outcrop containing about 10% lead.

Lead mining is being revived in Western Australia. After having been abandoned

Open pit worker available

HAS FOUR-YARD SHOVEL . . . WILL TRAVEL

Will travel . . . there's the key to the real value of an Allis-Chalmers HD-21G tractor shovel. It not only digs and loads four yards at a pass, it is mobile enough to work in all parts of the pit . . . and flexible enough to do many different jobs well.

Besides loading hauling units, the HD-21G can strip over-burden, help maintain access roads, build stockpiles, feed and clean up around conveyors, or even clear land for future operations.

Let your Allis-Chalmers dealer show you the many ways an HD-21G can put its big, four-yard shovel to work profitably for you. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

✓ happy balance between dependable performance and moderate cost

ROLLWAY STEEL CAGE ROLLER BEARINGS

Tru-Rol *precision, steel-cage, heavy-duty bearing with contoured guide lips assuring true right-line rolling, maintained roller alignment and thin oil film.*

● Rollway's *TRU-ROL* Steel-Cage Bearings afford wide latitude in balancing *dependable* performance, *long* life, and *high load* capacity against *moderate* cost. They rate high in any comparison on a cost-performance basis.

A choice of stamped steel retainers with contoured guide lips, or steel segmented retainers assure true rolling and an evenly distributed *thin* oil film — *big factors in reducing power losses and heating.*

TYPE D

Rollway Metric Series Steel Cage Roller Bearings

● Rollway Metric Series Steel-Cage Bearings offer the greater load capacity of solid cylindrical rollers, plus the true right-line rolling of trunnion rollers turning in a rigid steel cage. There's no roller skew, no pinch out, no cam action. Design permits maximum bearing capacity . . . within small space . . . at moderate cost.

"Crowned" Rollers Relieve End Stress

TRU-ROL offers the extra advantage of a finish-ground "crown" radius on the roller ends. That relieves high end-stress and insures uniform load distribution over the entire length of the roller. The result: *TRU-ROL* Steel Cage Bearings carry heavier loads over longer periods without excessive end-fatigue. They are less affected by slight misalignment or shaft deflection.

Investigate *TRU-ROL* Steel Cage Roller Bearings before selecting any bearing in the medium price range.

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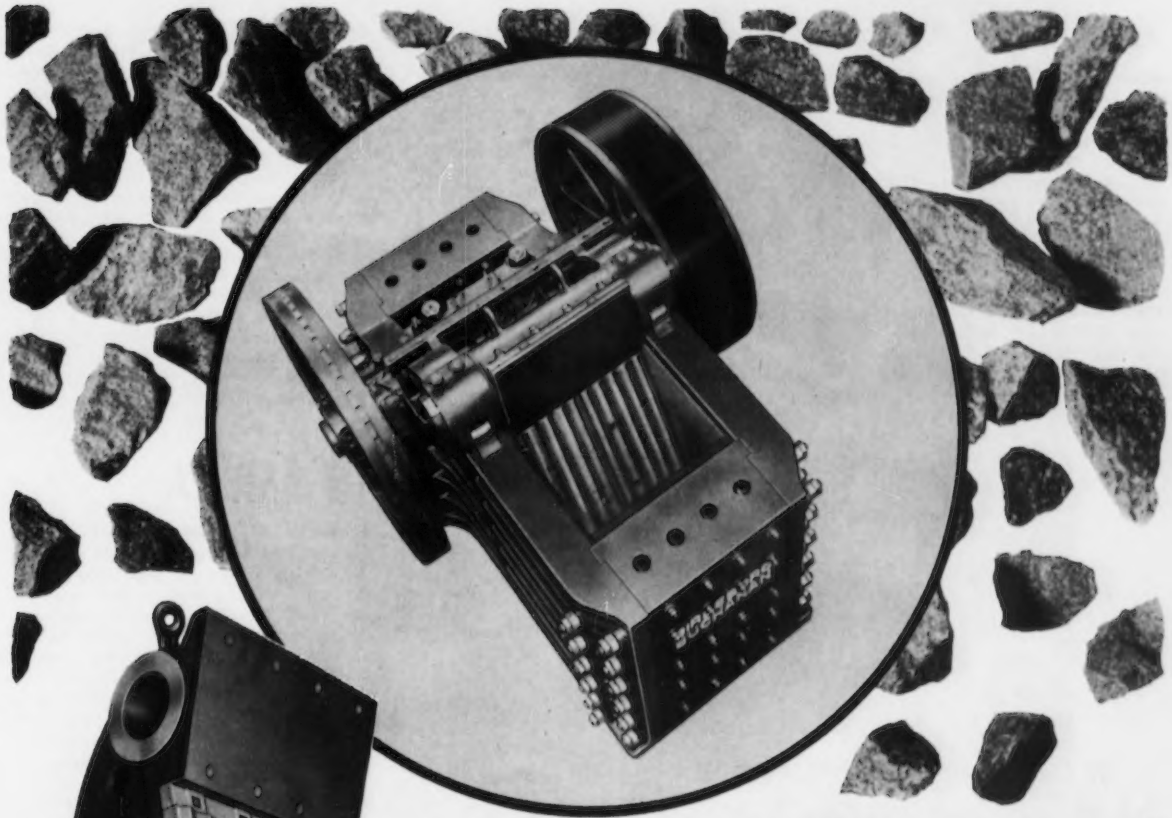

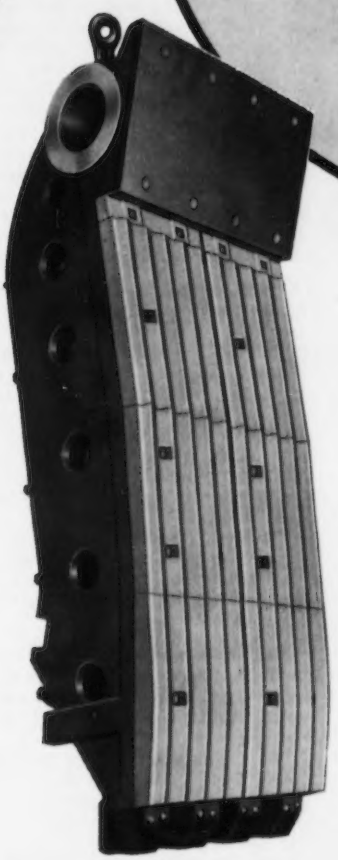

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Birdsboro-Buchanan Crusher Parts

Jolting impact and punishing abrasion are the destructive one-two punch of every stone-crushing operation. Obviously, a "pretty good" steel cannot stand up consistently and profitably under this constant sledgehammer pounding. That's why impact and abrasion resistant TISCO Manganese Steel jaw plates are used in Birdsboro-Buchanan Crushers. TISCO jaw plates last longer, keep production levels high, maintenance low.

Founded in 1742, Taylor-Wharton, the Original Producers of 12 - 14% Manganese Steel in America, has the know-how and experience in making special alloy steels with top impact and abrasion resistant properties. To find out how tough TISCO Manganese Steel alloys can up the output and decrease the down-time of your Jaw Crushers and other processing equipment, specify TISCO alloys.

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Australia (*Continued*)

about 25 years ago, the open-cut at the Two Boys lead mine near Galena is being worked again with highly promising indications. It appears that those working the mine in early thirties were only a few feet from a valuable lode. Work has also resumed at the Surprise Mine with carbonate indications and formations reported.

Production of pitchblende from ore stockpiles at the El Sharana mine has been resumed. The pitchblende concentration plant has been overhauled and remodelled for wet treatment. Mining of the Palette lode for pitchblende will begin soon. Diamond drilling has been resumed for extension of El Sharana and Saddle Ridge lodes.

First profits and first dividend payments from an Australian uranium mine have been announced by sister companies, Northern Uranium Development N.L. and Uranium Mines N.L. The mining profits, about $500,000 for each company, came from the sale of pitchblende concentrates. The two companies will be merged into United Uranium N.L.

Morning Star Mines N.L. reports significant developments in work on new deep reefs at the Woods Point gold mine. Assay values of 48 dwt over 18 in. were encountered in a horizontal diamond drill hole from No. 22 level. Same drill hole has also intersected two more previously unknown reefs at 93 and 144 ft. Highly payable quartz has been reported in several drives on reefs' intersections and assays averaged 24 dwt from 10 to 65 ft over a width of 60 in.

Northern Hercules N.L., a Northern Territory gold mine, has decided to continue development, exploration and production work at the mine.

It is hoped to accomplish this task without reduction in current output. Company has asked Federal authorities for a complete geological survey of the mine.

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Which one are you getting?

Let us show you how Brunner & Lay carbi e bits can pay off for you. Telephone our nearest plant.

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Body types—cross, chisel, "X", cutaway, taper-socket. Available in standard Wagon Drill & Hand Held Drill also; 600; 400; 200 series and J-7.50 thread. Bit sizes up to 6½" in our Hole-Master. Write for NEW complete catalog #756.

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IN AFRICA

Prototype of a new type of mineral concentrator designed and built in South Africa has passed its preliminary tests and full scale demonstrations open to the public are to be arranged shortly.

This new concentrator might be described as a mechanised mineral cascade. It is compact and fully adjustable.

Principles are based primarily on a new combination of gravity and centrifugal force—plus a vibration and oscillation which gives stratification of minerals of different specific gravity, thereby considerably assisting classification and at the same time greatly increasing the capacity of the machine.

Private company which has bought Rhodesian Iron and Steel Industry from the Southern Rhodesian Government for $12-million is to spend $24-million on a development program to increase output from its present 60,000 tons a year to 150,000 tons. A new blast furnace, two new open hearth furnaces and new cooking ovens are to be installed in the next four years. Later the industry will be expanded to produce sheet steel and wire rods.

Southern Rhodesian Government and seven British, Rhodesian and South African companies are shareholders in the new private company that has bought the industry.

Small prospectors and miners in Rhodesia and Nyasaland have received an offer from the United Kingdom Atomic Energy Authority to purchase uranium bearing ores.

For the next seven years the authority will buy ores containing up to 100 tons of uranium oxide, and will accept small consignments of not less than one-quarter ton of oxide.

To encourage and develop new sources, a special price will be paid for uranium oxide coming from completely new mines in the next five years.

Work has started on a $4.5-million titanium sand project at Umgababa on the south coast of Natal by Anglo American Corp.

It is estimated that in the main sands dump at Brakpan Mines there are about

Mechanization returns greater dividends with Edison R-4 Cap Lamps on the job

Edison R-4 Electric Cap Lamps can help modern mining machines realize their *full* potential.

Reason why? Because more and better light is always on the job with the brilliant, unfailing beam of the Edison R-4. This dependable source of illumination permits the miner to perform his duties with utmost efficiency and safety. You don't have long to wait for results with the Edison R-4, either. They register quickly in terms of accident prevention and increased tonnage per man-shift.

Let us demonstrate the advantages of this *quality* cap lamp in your underground operation. Write or call us soon for more detailed information.

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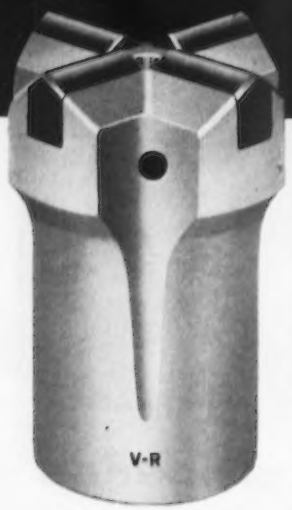
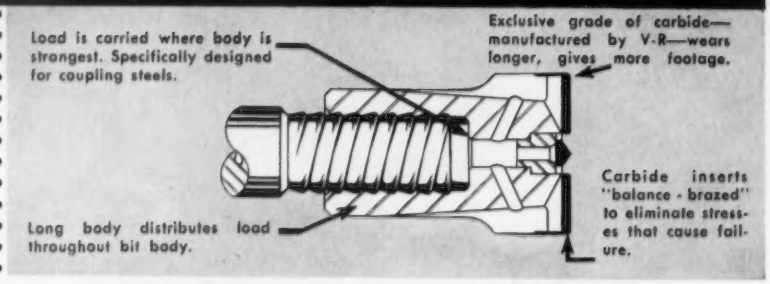
NEW! V-R "X" Style Percussion Bit

Non-Rifling
Proved best by test



Bottoming Type


Load is carried where body is strongest. Specifically designed for coupling steels.
Exclusive grade of carbide—manufactured by V-R—wears longer, gives more footage.
Carbide inserts "balance - brazed" to eliminate stresses that cause failure.
Long body distributes load throughout bit body.

Thread Type	Bit Sizes
600	2½ through 4½
700	2¾ through 4½
1000	4 through 5

Prevents Squaring in the Hole

The new V-R "X" type carbide tipped rock bit eliminates squaring in the hole often encountered with cross-style bits. It drills clean, round deep holes faster at lower cost than any other bit you can buy.

Exclusive V-R Carbides—developed *and manufactured* by V-R, a leader in the carbide industry since 1930.

Faster Penetration—the impact load is carried a shorter distance than with a shoulder type bit, producing greater penetration on every impact.

Longer Thread Life—load on the threads is much less than in shoulder type bit, minimizing chance of thread strippage.

Less Chance of Ring-off—the major impact load is carried at the bottom of the bit body, reducing load on the skirt which is the primary cause of rock bit ring-off.

"Balance-Brazed" Carbide Tips—prevent stresses that cause premature bit failure.

Try them . . . and you'll buy them—the bits that are beating them all: V-R BITS.

Ask for percussion bit catalog and prices

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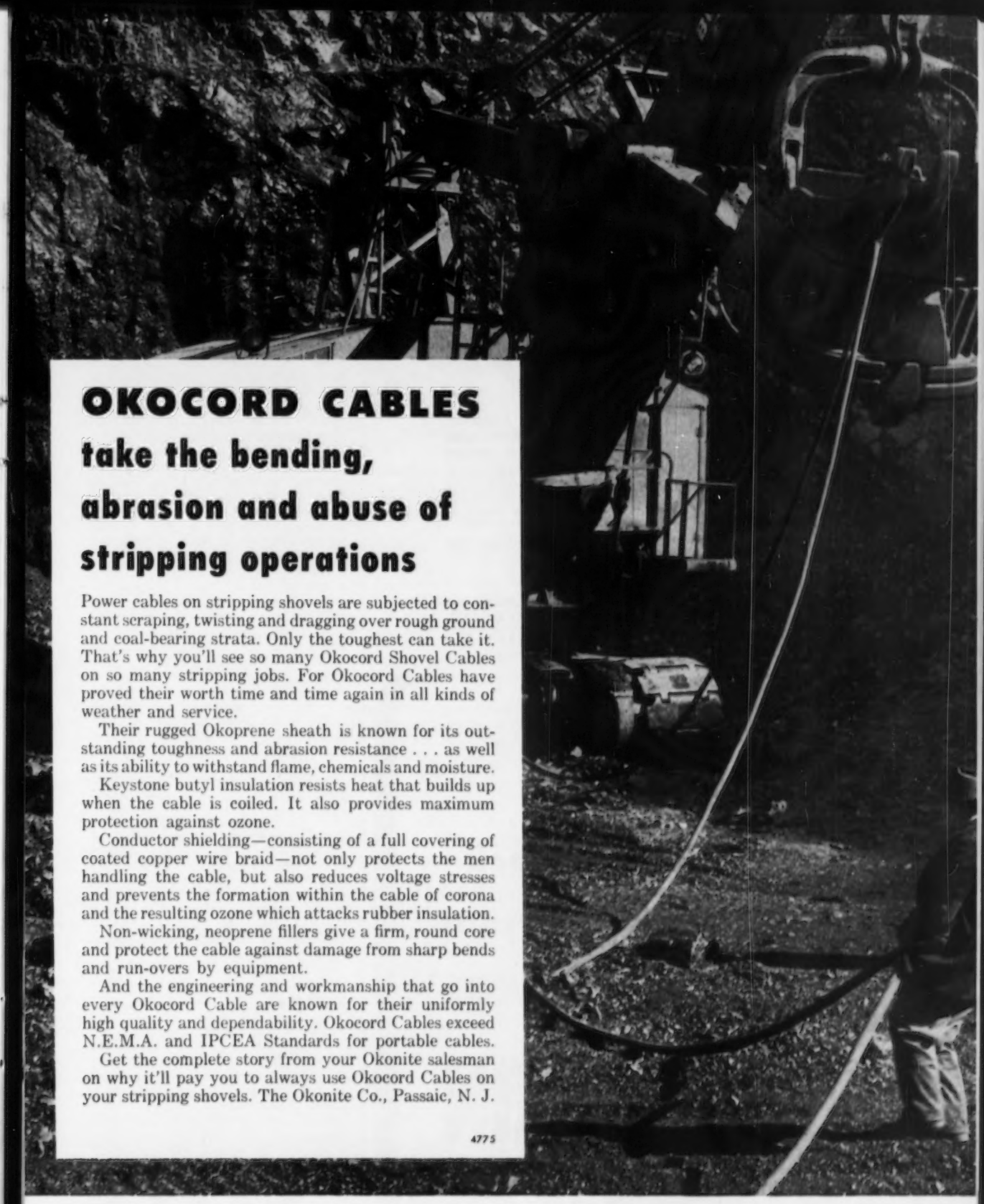

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take the bending, abrasion and abuse of stripping operations

Power cables on stripping shovels are subjected to constant scraping, twisting and dragging over rough ground and coal-bearing strata. Only the toughest can take it. That's why you'll see so many Okocord Shovel Cables on so many stripping jobs. For Okocord Cables have proved their worth time and time again in all kinds of weather and service.

Their rugged Okoprene sheath is known for its outstanding toughness and abrasion resistance . . . as well as its ability to withstand flame, chemicals and moisture.

Keystone butyl insulation resists heat that builds up when the cable is coiled. It also provides maximum protection against ozone.

Conductor shielding—consisting of a full covering of coated copper wire braid—not only protects the men handling the cable, but also reduces voltage stresses and prevents the formation within the cable of corona and the resulting ozone which attacks rubber insulation.

Non-wicking, neoprene fillers give a firm, round core and protect the cable against damage from sharp bends and run-overs by equipment.

And the engineering and workmanship that go into every Okocord Cable are known for their uniformly high quality and dependability. Okocord Cables exceed N.E.M.A. and IPCEA Standards for portable cables.

Get the complete story from your Okonite salesman on why it'll pay you to always use Okocord Cables on your stripping shovels. The Okonite Co., Passaic, N. J.

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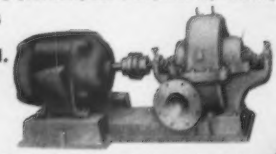
where there's electrical power . . . there's **OKONITE CABLE**

Faithful Performance on Important Jobs

— such as water supply, brine circulation, booster service, white water and overflow, hot well, makeup water, etc., etc.

Capacities to 1,400 G.P.M.

Heads to 460 Ft.



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AURORA APCO Turbine-type PUMPS are unbeatable on low capacity, high head duties.

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Africa (*Continued*)

3-million tons of payable sands overlaid by about 1.5-million tons of unpayable sands.

Equipment is being installed to remove this overburden and to return the pay tonnage for treatment to the reduction plant.

IN ASIA

INDIA

East and West German, British and some U.S. equipment now is in position to commence a three year operation at Neiveli, Madras State, to mine for lignite, which will be used to produce 200,000 kw of power and 20,000 tons of ammonium nitrate per year.

Miners will start to dig 180 ft below ground surface to reach the lignite stratum. Simultaneously, work will be taken up on a pilot project to manufacture briquetes out of lignite. Samples so far taken in the area show the following composition: moisture 56%; ash 2.5%; volatile 22.4% and carbon 19.1%.

An investment of around $36 millions is planned for the mining part of the project. The $40-millions power plant will be located at the mining site as also a $40-millions fertilizer factory in which lignite will be converted into synthetic gas for the production of ammonia. Two hundred thousand tons of gypsum per year will be required for the production of ammonium sulphate.

The Indian government has just sanctioned the first $20-millions, which is the investment to be made in briquettes manufacture. U.S. mining engineers under the Technical Cooperation Mission have carried out extensive surveys of the Neiveli area.

Japan is expected to send an official mission to India this autumn to conduct an on-the-spot survey of the Rurekala iron mines in Orissa which Japan may help develop with U.S. economic aid. Japan's leading steel makers—Fuji, Yawata, Kawasaki, and Japan Steel Tube—are interested in the projected Japan-India joint venture.

BURMA

Yawata Iron & Steel Co., a leading steel manufacturing company in Japan, has said that a plan for a Japanese-Burmese joint project to develop iron ore mines in the Victoria Point district, Southern Burma, is in progress.

Five Japanese companies, including Yawata and Fuji Iron and Steel companies, and the Mineral Resource Development Corp. of Burma are planning to establish a mine development company, investing 50-million to 100-million Yen.

Japanese companies sent a survey mission to the district in late 1956. The Mah Puteh Mine and the Kho Ghum Mine, with estimated deposits of about

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Complete Motor Line

multi-speed

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face mounted

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dc series wound

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vertical solid shaft

totally enclosed

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. . . plus quality and service

As part of a national network of more than 200 franchised outlets, your nearby Allis-Chalmers Motor Distributor offers the rare combination of *fast service* and a *complete line* of *fine-performance* integral horsepower motors. He's the right man to give you just the right motor — in a hurry.

It adds up to:

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GET ACQUAINTED with your Allis-Chalmers Motor Distributor soon. You can find out his name by contacting the A-C sales office in your area, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

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ALLIS-CHALMERS

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"This is the best thing I've found in Air-operated clamshells"

states James Williamson of Williamson Shaft Contracting Company about—

THE NEW BLAW-KNOX MUCKING BUCKET

These words of praise for this new bucket were by a man who has been in the shaft contracting business since 1900, Mr. Williamson went on to say—"It loads faster and has much more closing power. In addition to that, because of its balance and streamlining, I believe it is much safer to operate."

This bucket, operated on normally available 85 to 100 pounds air pressure, suspended by a single cable attached to a hold line socket at the head of the bucket. It is closed or opened by an attendant pulling one or the other of two chains attached to the walking beam type opening and closing valve. Available in ⅜ and ⅝ cubic yard sizes for stock shipment. For complete information contact your Blaw-Knox dealer.

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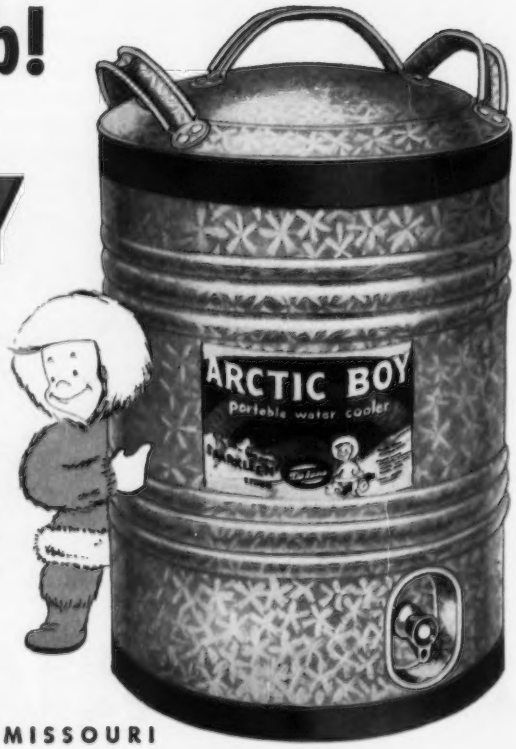
portable water coolers

Keep workmen on the job by keeping sparkling pure, refreshingly cool drinking water on the job.

ARCTIC BOY Coolers are big, rugged, built to take abuse. They feature double-locked seams and bottoms, brass-nickel plated recessed faucets, fully enclosed or open-rimmed covers. There's the new SPARKLEEN liner, too, that keeps water sparkling clean, odor-free and taste-free. Large opening, straight sides make them easy to ice and clean.

You'll find ARCTIC BOYS are a money-saving investment everywhere they're used.



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Why the LINK-BELT Series 100 is

TODAY'S MOST WIDELY ACCEPTED BELT IDLER

Here's what men who know idlers have to say

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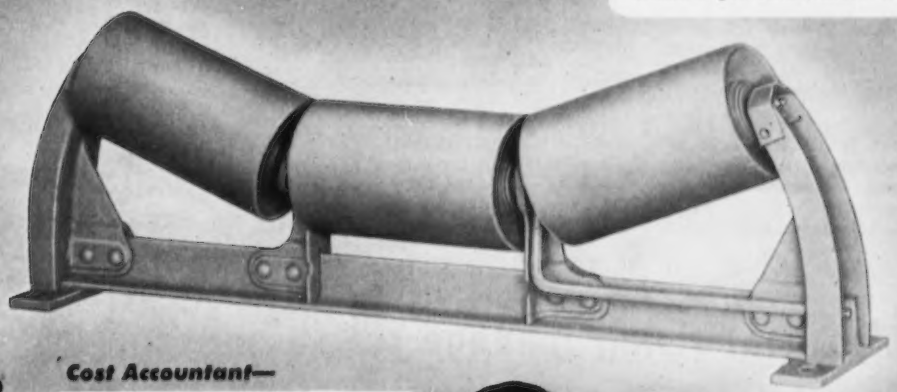
"Service records of the Link-Belt Series 100 belt conveyor idler show that there's no more durable belt conveyor idler in the capacity range. It's a 'work horse'—gives economical service under hard duty, conveying all but the heaviest and coarsest materials."

Engineer—

"Look at these design features. Self-contained, concentric rolls with bearings fully enclosed and protected . . . strong heavy ribbed brackets and sturdy rigid frames maintain accurate roll alignment—won't spread under load . . . hex nuts that lock rolls in brackets, preventing shaft rotation."



Cost Accountant—

"All costs considered—installation, operation and maintenance. You won't find a better buy in belt conveyor idlers than the Link-Belt Series 100. Its free-rolling action requires less power . . . reduces wear on operating parts and belt . . . cuts replacements."

Maintenance Man—

"Its cartridge seal is the best I've seen . . . has no springs, clips and other small parts to lose . . . cuts servicing time when required. It's tops for keeping grease in, dirt out under the grimiest conditions. Grease fittings are protected, easy to reach."

Broad range of types meets all material and operating requirements

RUGGED . . . free-rolling . . . dirt- and dust-proof—the Link-Belt Series 100 belt conveyor idler combines these and other features for low-cost, dependable materials handling under severe, continuous service conditions. What's more, you have a wide choice of types for any requirement—whether you handle coal, sand, gravel or iron ore . . . sticky or free-flowing materials.

Sturdy rolls of the Series 100 are accurately machined for concentricity—welded for added strength and to keep out dirt and moisture. Smooth, round surfaces and edges prevent belt damage. As for dependability of its roller bearings—Link-Belt has *never* known a bearing failure due to overloading a Series 100 idler. Equally important, strong malleable iron brackets and sturdy, rigid frames maintain accurate roll alignment.

For facts on the Series 100 belt conveyor idler, see your nearby Link-Belt office or authorized stock-carrying distributor. Or write for Book 2416.

LINK-BELT

BELT CONVEYOR IDLERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,493

Burma (*Continued*)

2-million tons in total, are situated in that district. They produce ore of 60 to 57% Fe content, according to a statement of the Yawata Co.

Mr. U Ba. Tun, president of the MRDC is going to Japan shortly to discuss the project.

IN EUROPE

ITALY

FIAT has asked the Ministry of Industry and Commerce for license to prospect for radioactive minerals in the vicinity of Monte Rocciacotello on land owned by various municipalities in the vicinity of Pinerolo, Turin Province and other areas in the North.

Ministerial Decree has granted Monterosa Gold Mining Co., London (of which Commissioner Gai of Turin is managing director) right to work the gold mine of Kreas, 3 km from Alagna, on the banks of the Sesia.

Existence of rich potash beds in Sicily, which was ascertained last year, has now been officially confirmed.

Recently, while research was being made to ascertain the consistency of some sulphur mines, a bed of kyanite was found estimated at 25-million ton, at Boasco, near Serra di Falco.

Last year, carnallite beds were found at Villapriolo (Enna) and at Salinella (Caltanissetta). Size has not yet been ascertained but it is believed to be very large.

HUNGARY

Miners of Pecs district uranium mines have been "lent out" to Pecs coal mines, according to an announcement. This move was motivated by heavy surface damage done during October/November rebellion in the area. Uranium district was one of the centers of the armed uprising of Hungarian freedom fighters.

Smaller part of Pecs uranium miners are employed to clean up damaged area; all mining activities have stopped. Shafts are reportedly flooded, the surface installations dynamited by freedom fighters. Damage is so heavy that resumption of mining there has been termed an entirely fresh start rather than mere resumption of work.

Hungary's bauxite production—reaching an all-time high during 1955 with 1,400,000 metric tons produced—has decreased to 1,100,000 metric tons on account of the Hungarian people's October rebellion against the Communist regime. The October events brought the partial destruction of bauxite mine installations, crippled the transport system and scattered the specialized workers all over the country.

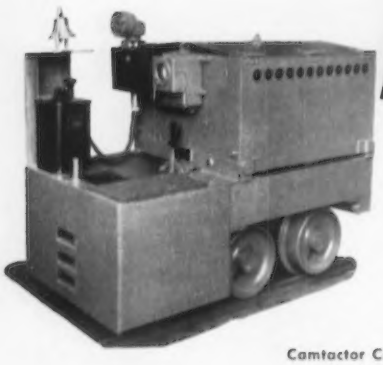
A further decrease is expected for the current year—900,000 metric tons at the most—thus falling back to the 1951/1952 level. Exports of bauxite, however, will this year exceed production: About 1,050,000 metric tons are to be shipped, i.e. the total 1957 output plus the greater part of the mine-stored materials. In the absence of exact figures on the amount of stored bauxite, it must be believed, that bauxite remaining for the Hungarian aluminum industry will be nearly zero.

Shortage of coal and electricity is claimed to be the main reason for not keeping up with the Hungarian aluminum production, but Western observers believe that the Soviets, in return for shipping 1,010,000 Rubles worth of goods to Hungary in 1957 (of which 60% are on a grant basis, the 1957 level being double the so far all-time high import of 1952) demand all the Hungarian bauxite in order to further step up Soviet aluminum production. (The Soviets, having produced 46,000 metric tons of raw aluminum during 1946, during 1955 have been believed to have produced close to 500,000 metric tons—most of it with Hungarian bauxite.)

POLAND

Plans for industrial processing of Polish

. . . helps beat rising tonnage costs



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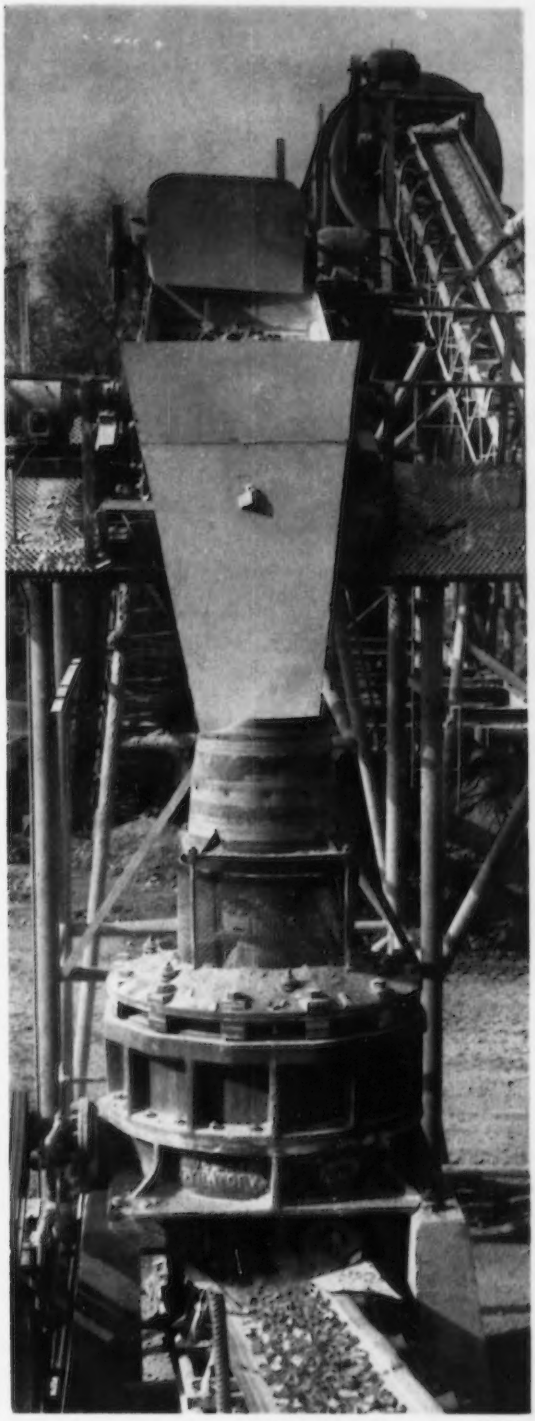

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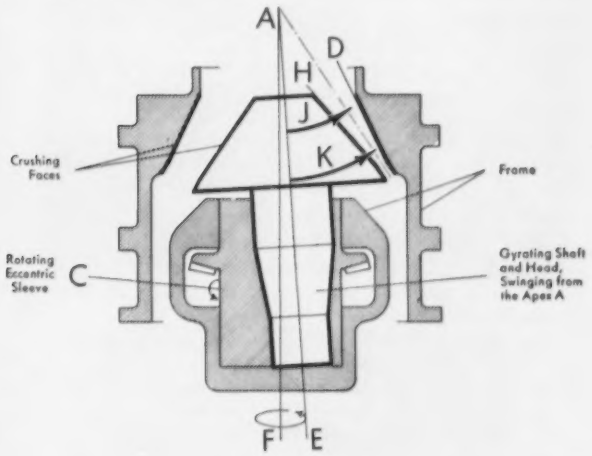
KUE-KEN® GYRATORY CRUSHER

Kue-Ken is designed for low head room and choke feed so that this economical method of reduction can be adapted to most any flow sheet. It is the only gyratory crusher that operates on the "crushing without rubbing" principle that eliminates the main cause of liner wear. Kue-Ken liners give prolonged, trouble-free service under continuing, hard-materials crushing. This exclusive design also speeds crushing, increases capacity and economizes on power. Though exceedingly strong, Kue-Ken is sufficiently compact and light that it may be used in either a permanent or portable installation.



Kue-Ken crushes without the upward abrasive action that quickly wears out liners on ordinary crushers. See how crushing faces above pass through crushing zone on arcs J and K to crush rock *squarely*. Only Kue-Ken operates on this principle.

"Crushing without rubbing" lengthens liner life

WRITE FOR CATALOG

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"CRUSHING WITHOUT RUBBING"

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BUT don't sashay that shaft-mounted speed reducer!

With the American Shaft-King there's no swing-and-sway for belt take-up—no rock-and-roll of the reducer housing that changes the oil level and may mean too much or too little oil! You *know* the oil level is exactly correct—you *know* those accurately machined gears and bearings are getting the protection they need! You *know* thermal conditions inside the case are ideal!

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- Shaft-King is compact and trim. Its appearance reflects its superior design.
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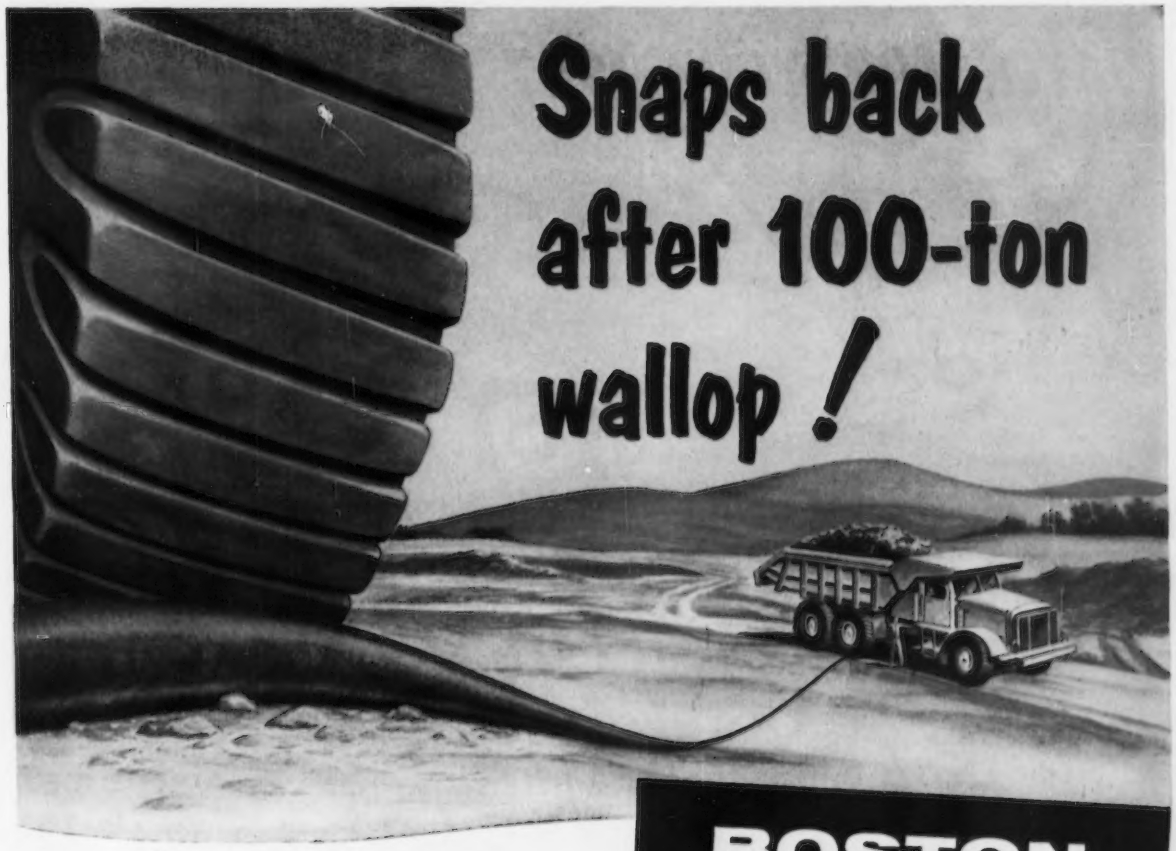
The Buyers' Guide Section in E&MJ's Mid-June, 1957, Mining Guidebook out later this month is the most comprehensive listing of manufacturers available in the industry. Product listings are based on information obtained from all known manufacturers serving the field — a company-by-company check conducted by the E&MJ editors just for this 1957 edition. Manufacturers advertising in this issue appear in bold-faced type in the Buyers Guide. You'll find more helpful product information in their advertisements.

E&MJ's MID-JUNE MINING GUIDEBOOK AND BUYING DIRECTORY ISSUE is an established annual service for all E&MJ subscribers.



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AIR HOSE

This is the hose built to take the most brutal treatment. So strong it snaps back even after being battered by a loaded Model LLD Euclid — a gross weight of 203,300 pounds!

When you consider that 45% of air hose failure is caused by *external* conditions, Boston Concord Yellow Jack is definitely the air hose to choose for your toughest jobs. It has the stamina to handle repeated rugged impact . . . the strength to withstand the highest internal pressures.

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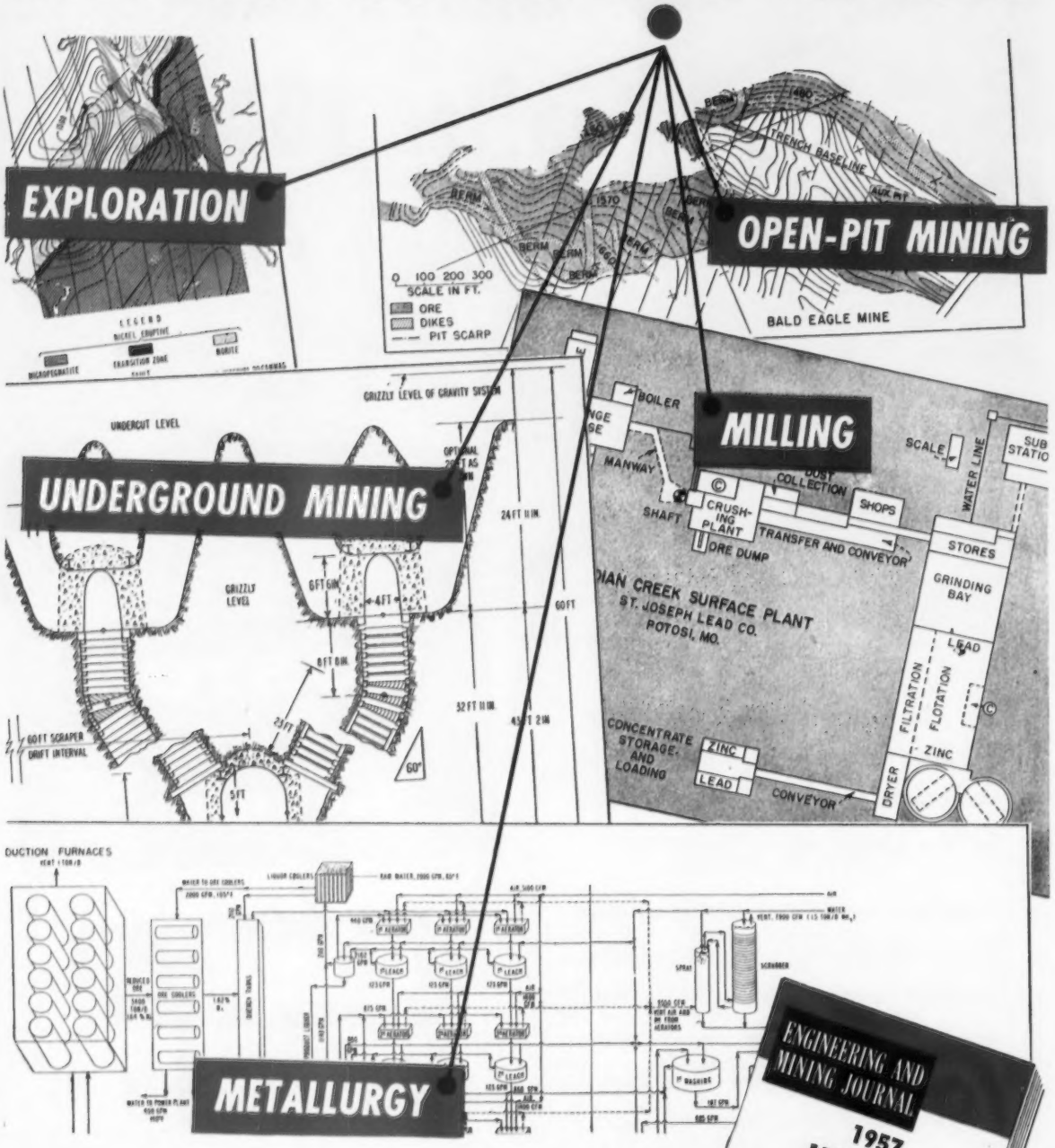

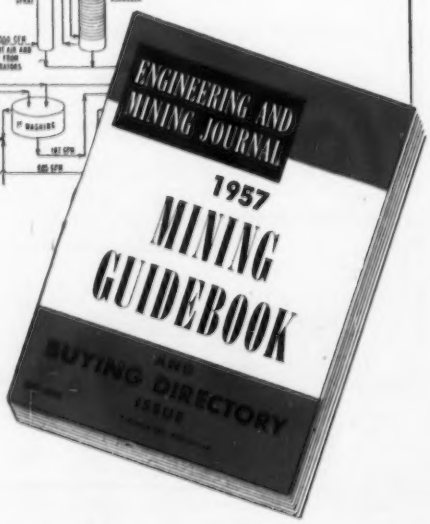

COMING IN THIS MONTH
KEEP IT HANDY FOR REFERENCE

Whether you're working on a specific problem, looking for ideas or seeking helpful operating data, it will pay you to check E&MJ's 1957 Guidebook going to all subscribers in Mid-June. It contains the largest section of useful operating information ever published in any one mining magazine. You'll also find the Buying Guide an easy-to-use, up-to-date reference to the thousands of products manufacturers offer. E&MJ's Mid-June Mining Guidebook Issue is an annual service for all E&MJ subscribers—included as a part of your regular subscription. Be sure to watch for it later this month.

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Twice the rope life

**Case histories show the proof. Yellow Strand Flattened Strand Wire Rope is making records of double the life, and even more, compared to round strand construction wire ropes. Ask your distributor, or write us for actual records on its performance.*

...with YELLOW STRAND Flattened Strand Wire Rope

It has greater surface area! It has 10% greater strength! It's more crush resistant! It gives up to double, or more, the life of round strand rope! These are, briefly, the profitable advantages of Yellow Strand Flattened Strand on your dozers, scrapers, draglines, trench hoes and hoist lines.

And Yellow Strand Flattened Strand is "always on hand" at your nearby Broderick & Bascom distributor. You can depend on his specialized "know how" in recommending the right rope for your equipment. You can benefit by his prompt attention to your needs — backed by nationwide factory and warehouse stocks by B & B.

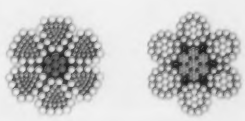
Specify Yellow Strand Flattened Strand on your next wire rope order and get the proof of lower overall costs and longer life. Ask your nearest B & B distributor, or write direct to us for more information on all your wire rope needs.

Yellow Strand

...always on hand

Here's Why Flattened Strand Lasts Longer

Compare Yellow Strand Flattened Strand with round strand wire rope (at right). In Flattened Strand you have twelve contact points, greater bearing area, smoother surface, less wear. Result: longer service, lower final cost.



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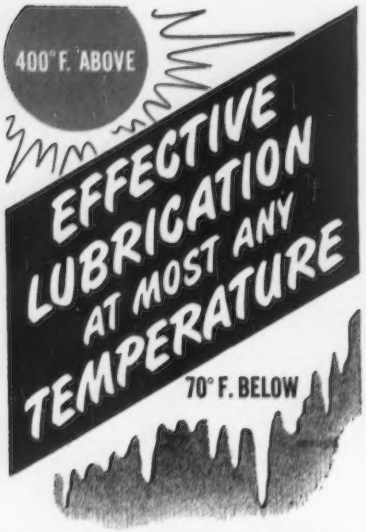

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LUBRIPLATE No. 930-AA.—Provides superior and protective lubrication for all types and sizes of machines operating at temperatures as high as 500°F. Possesses exceptionally high film strength and adhesiveness. Protects all metallic parts against rust and corrosion.

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DISCUSSING DETAILS of the Spokane conference are (left to right) W. E. Davis, USGS; E. C. Stephens, of Anaconda Co.'s Spokane office; A. E. Weissenborn, USGS Spokane office; W. S. March, associate director of the Montana Bureau of Mines at Butte; Neil Roby, Minerals Engineering Co.; and Eric G. Robinson, USBM.

Geophysicists Discuss Ore Search Methods

NEW METHODS IN AERIAL PROSPECTING and photogeology were outlined at the Spokane Conference on Geophysics and Photogeology Applied to Ore Search.

The conference, Mar. 14 and 15, was attended by nearly 300 mining industry representatives. Sponsorship was by the Northwest Mining Association, Spokane Chamber of Commerce Mining Bureau, Columbia section of the American Institute of Mining & Metallurgical Engineers, and British Columbia section of the Canadian Institute of Mins & Metallurgy.

Speakers included: Hans Lundberg, president of Lundberg Explorations, Ltd., who discussed successful gravity gradiometer tests; W. E. Davis, head of the USGS geophysics branch on geophysical applications; Lawrence Brundall, vice president of Geophoto Services, Denver, who encouraged use of photogeology in ore search.

Uses of color photography were outlined by R. L. Ray, Washington office of USGS; William A. Fischer, chief of the photogeology section of USGS's Alaska branch described orthophotography, which he said will do away with distortions in normal photography and provides the accuracy of a map; Earl F. Cook, acting dean of the University of Idaho College of Mines, said that photogeology is "probably most useful in structural interpretation and in the location of geologic anomalies such as zones of faulting, intrusion or alteration."

A trend toward more compact geophysical prospecting equipment and simpler chemical tests was noted by Ralph C. Holmer, Denver, chief geophysicist for Kennecott Copper's exploration branch. W. B. Agocs, chief geophysicist for Aero Service Corp., Philadelphia, told the conference that available airborne geophysical instruments permit measurements of variations of the magnetic field, gamma radiation and conductivity. Other speakers included Robert Denison, chief geophysicist for Nuclear Thermal Survey, Inc., Golden, Colo., and J. K. Crosby, geophysicist for Pacific Geophysics, Ltd., Vancouver, B. C.

Poland (*Continued*)

uranium ore are being drawn up at the present time, according to government's representative for atomic matters, Mr. Billig. In an address he stated that "Poland lacks necessary knowledge and funds to process uranium ore successfully and therefore has agreed to sell to the Soviet Union all Polish uranium ore mined".

Annual Reports (*Continued*)

Jones & Laughlin Steel Corp. reported 1956 sales at $742,642,000 and net income at $45,122,000. Capital expenditures, toward a steel ingot capacity of 7.5-million tons by year-end 1957, was $113.2-million. Further expansion in 1957 through 1959 will call for an additional $200-million.

At Aliquippa, a blast furnace was enlarged and considerable additional equipment was installed. At Cleveland, a new ore sintering plant was installed along with other new equipment.

J&L will take over Rotary Electric Steel Co. (300,000 ton annual output), if stockholders approve.

During the year, J&L's iron mines produced 5,321,000 tons of ore and the company purchased an additional 2,172,000 tons. J&L has four open pits on the Mesabi, an underground mine in Michigan and an open pit in New York. New mine in Minnesota will be in production in 1958. J&L acquired 57-million tons of additional iron ore reserves through a lease on property near Kirkland Lake, Ontario. Proven ore reserves of the company now stand at 230-million tons.

Rio De Oro, in their first annual report, stated that company has 37% interest in Homestake-New Mexico Partners 830-tpd

the expert fisherman
has his rod custom-made
because he gets
something **EXTRA**

the profit-wise operator

BUYS TRAYLOR REDUCTION CRUSHERS for the same reason

Traylor Reduction Crushers are famous throughout the industry for the extra *production* and extra *profits* they put into mining operations. Traylor-made in ten sizes, with feed openings from 1½" to 22", Traylor Reduction Crushers provide capacities up to 590 tons per hour. For complete specifications write for Traylor Bulletin No. 11-120.

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equipment for peak performance

A Traylor leads to greater profits

WEIGH WITHOUT STOPPING

WHILE YOU **CONVEY**

Yes, weigh and record with the —MERRICK

WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service. Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

MERRICK SCALE MFG. CO. PASSAIC N. J.

Annual Reports *(Continued)*

mill at Grants. Ore reserves at Dysart No. 1 are sufficient for mining 400 tpd for next ten years. Mining conditions at Dysart are quite favorable for large scale and low-grade mining, public opinion to the contrary and Rio states that no timber or roof bolting has been necessary, and that no water has been encountered. Mine is only 350 ft deep.

Rio's Ike No. 1 mine has ore thickness of 50 to 150 ft, and company feels that this mine will become the most valuable asset. Rio also has several other leases which are being drilled in Ambrosia Lake area.

Great Northern Iron Ore Properties shipped 7,869,270 tons from their mines in 1956. Net income was $3,762,680. Company will liquidate all of the seven remaining proprietary companies, due to change in Minnesota law.

Siskon Corp. operated mine and gold mill in Siskon County, Calif., with a net profit of $219,019. However, exploration and costs not directly connected with operating the mine reduced income to $35,162 net. Because of the size of the orebody, company is considering raising mill capacity to 250 tpd. Siskon has purchased Old Reliable copper mine. Siskon feels that mine has $10-million worth of 35c copper, and that it can be recovered by leach-precipitation-flotation methods. Siskon will try to finance a 500- to 600-tpd mill.

Patino Mines & Enterprises Cons., Inc. reported that only 7,919 tons of fine tin were exported from Government-operated mines formerly held by the company, as against 10,558 long tons in 1951, under Patino operation. No settlement has yet been paid to Patino.

Montgomery Explorations Ltd. reported mine near production. Reserves are indicated at 7,887,218 tons, 1.85% Li_2O. Company is negotiating with American Metal Co. to get American Metal to build a concentrator and market the concentrate.

Tanganyika Concessions Ltd. showed a record profit of £3,982,612 for year ending July 1956, and once again Union Miniere du Haut-Katanga provided most of the income. Union Miniere mined 8.9-million tons ore with Musconi and Ruwe furnishing 54% and 31% respectively, and the rest came from Kisishi, Star, Luiswishi, Shamituma and Lukuni. Kamoto is stripping over burden preparatory to mining. Extraction of uranium-radium ore continued at Shinkolobwe.

Union Miniere's total copper production was 234,673 tons in 1955. In addition cobalt, zinc concentrate, cadmium, uranium-radium concentrate and germanium-bearing materials were produced. Company is researching Fluo-Solids roasting and recovery of zinc and germanium from slag at Lumbumbashi.

Tanganyika Holdings Ltd. is entitled to 30% participation in any discoveries made in certain areas (12,000 sq miles) over which Rio Tinto holds exclusive prospecting rights in Northern Rhodesia. Tanganyika holds interest in Rhodesia-Katanga Co. Ltd., which owns 35% of Kansanshi Copper Mining Co. Ltd., and owns perpetual mineral rights to 2,500 sq miles of Northern Rhodesia. Tanganyika also holds interest in Kentan Gold Areas Ltd., which milled 260,150 tons for working profit of £27,295.

Consolidated Gold Fields of South Africa, Ltd. reported that its wholly owned subsidiary New Cons. Gold Fields Ltd. produced 2,055,000 oz gold from mines operated in South Africa. West Witwatersrand Areas Ltd. holds interest in following companies: Doornfontein Gold Mining Co. Ltd. (£1,067,773 profit); Blyvooruitzicht Gold Mining Co. Ltd. (£5,901,294 profit from gold and uranium); West Driefontein Gold Mining Co. Ltd. (£5,690,917 profit and ore reserves of 1,438,000 tons) has uranium mill onstream; Lebanon Gold Mining Co. Ltd. (£675,630 profit); and Venterspost Gold Mining Co. Ltd. (working profit was £898,782).

In Transvaal—West Rand, Luipaards Vlei Estate and Gold Mining Co. Ltd. had working profit of £568,016 from gold and uranium. Transvaal—Central Rand, the Robinson Deep Ltd. showed working profit of £216,902, but will stop mining deeper levels due to severe rock bursts. Simmer and Jack Mines, Ltd., in same area, reported £206,941 profit, while

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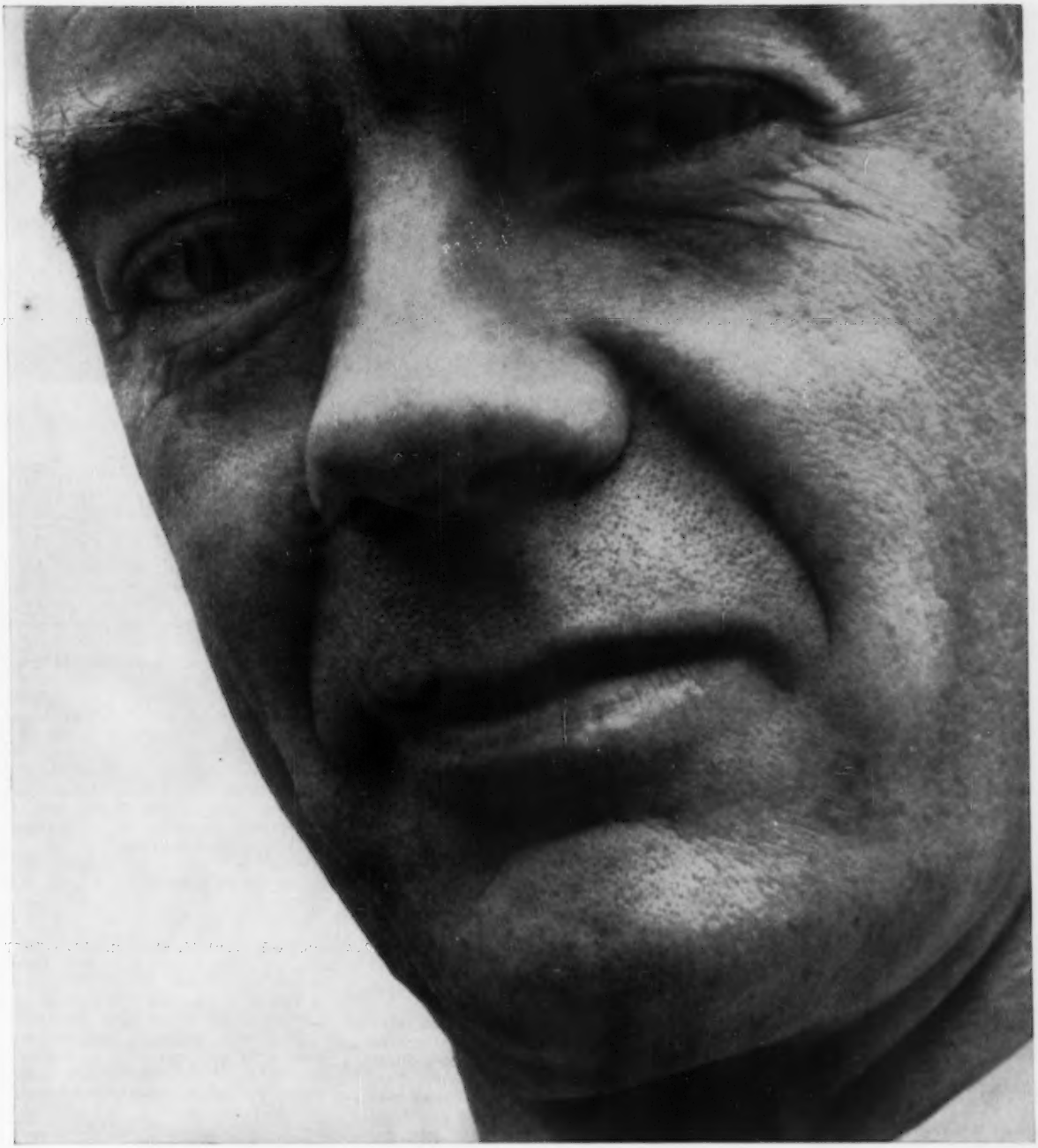

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WASATCH RANGE frames Bear Creek's new "Burgin" shaft headframe in Utah, where the Kennecott subsidiary is searching for lead-zinc-silver ores.

Kennecott Project Honors Late W. A. Burgin

BEAR CREEK MINING CO., wholly-owned domestic exploration subsidiary of Kennecott Copper Corp., has named its new Eureka, Utah, shaft in honor of the late William A. Burgin. The project is biggest lead-zinc venture in Utah in last quarter century.

Mr. Burgin, former district exploration chief for Bear Creek at Denver, Colo., initiated the work on the project, which will seek commercial development of lead-silver-zinc ore below 1,000 ft in the famous Eureka mining area.

Mr. Burgin, a native of Springfield, Mo., and graduate of Missouri School of Mines, perished in a commerical airliner tragedy in flight to Salt Lake City from Denver 1½ years ago.

The Burgin shaft, now being sunk below 100 ft by Centennial Development Co., Eureka mine contractors, will be completed to total depth of 1,080 ft by late July or August, according to Ray E. Gilbert, Denver, Colo., present district chief.

The shaft is being sunk on Apex Standard Mining Co., ground. Apex is an affiliate of Chief Consolidated Mining Co., which joined the Tintic Group of Companies (Tintic Standard Mining, et al) in the Bear Creek joint venture.

Mr. Gilbert confirmed that three mineralized areas had been penetrated by drill prior to launching the present exploration by drift, cross-cut and tunnel from the two-compartment shaft.

Centennial will cut operating stations at about 1,050 ft, Mr. Gilbert said.

The firm is using the Cryderman mucking machine in sinking.

Allen Steel Co., Salt Lake City, erected the 50-ft headframe.

Annual Reports *(Continued)*

Driefontein Cons. Mines Ltd. had profit of £237,443.

In Transvaal—East Rand area, Vlakfontein Gold Mining Co. Ltd. reported £871,960 profit. Output is now 50,000 tons ore per month. Vogelstruisbult Gold Mining Areas Ltd. combined profit from gold and uranium was £1,628,962. Ore reserves are 2,885,000 tons. Sub Nigel Ltd. gold working profit was £1,098,995.

In Transvaal-Klerksdorp area, Hartebeestfontein Gold Mining Co., Ltd. is earning a profit after only 2½ years since start of shaft sinking. Ore reserves are 1,682,000 tons, 9.6 dwt gold.

In Transvaal—Rustenburg area, Rustenburg Platinum Mines Ltd. will expand operation at a cost of £2.25-million. Waterval (Rustenburg) Platinum Mining Co. Ltd. holds interest in Rustenburg, above, Potgietersrust Platinum Ltd. and Union Platinum Mining.

Elsewhere in Transvaal, Argent Lead and Zinc Co. Ltd. started mining operations in 1956.

In Orange Free State, Free State Saaiplaas Gold Mining Co. Ltd. is sinking two shafts to 6,000 ft. Free State Geduld Mines, Ltd. started production in January 1956, has ore reserves of 1,264,000 tons, 16 dwt gold. Harmony Gold Mining Co. Ltd. had working profit from gold and uranium amounting to £2,471,367. St. Helena Gold Mines, Ltd. showed working profit of £757,917.

Consolidated Mines, Inc. shipped 581,685 tons chrome from company mines located at Masinloc, Sambales and had a gross income of P20,332,880. Benguet Cons., Inc., operator of all Consolidated Mines, reports that reserves are 4,362,800 long tons of mill feed. Company is trying to develop market for minus 10 mesh fines.

Phillips Petroleum Co. had gross sales $1,038,814,810 and net income of $95,202,615. Company has proven uranium ore reserves of 2,800,000 tons of above-average-grade ore in Ambrosia Lakes. Phillips, whose primary interest has been oil, gas and chemicals, has asked the AEC for permission to build a uranium mill near Grants, N.M.

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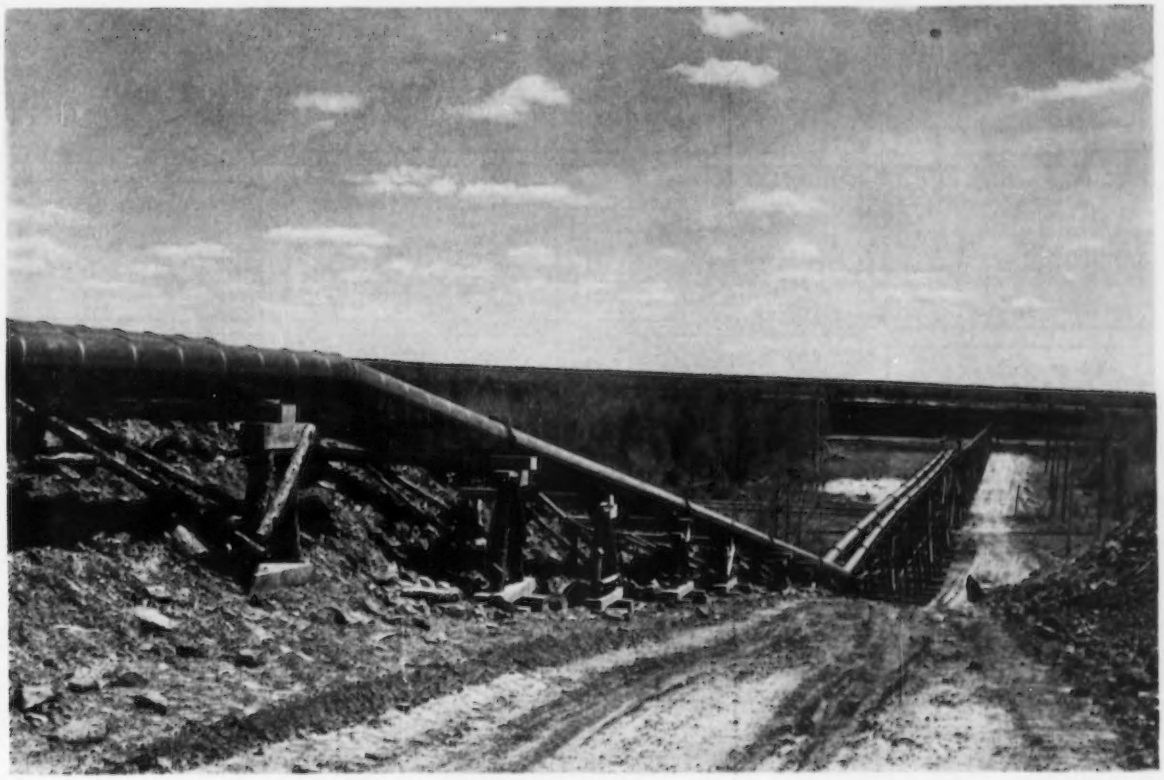

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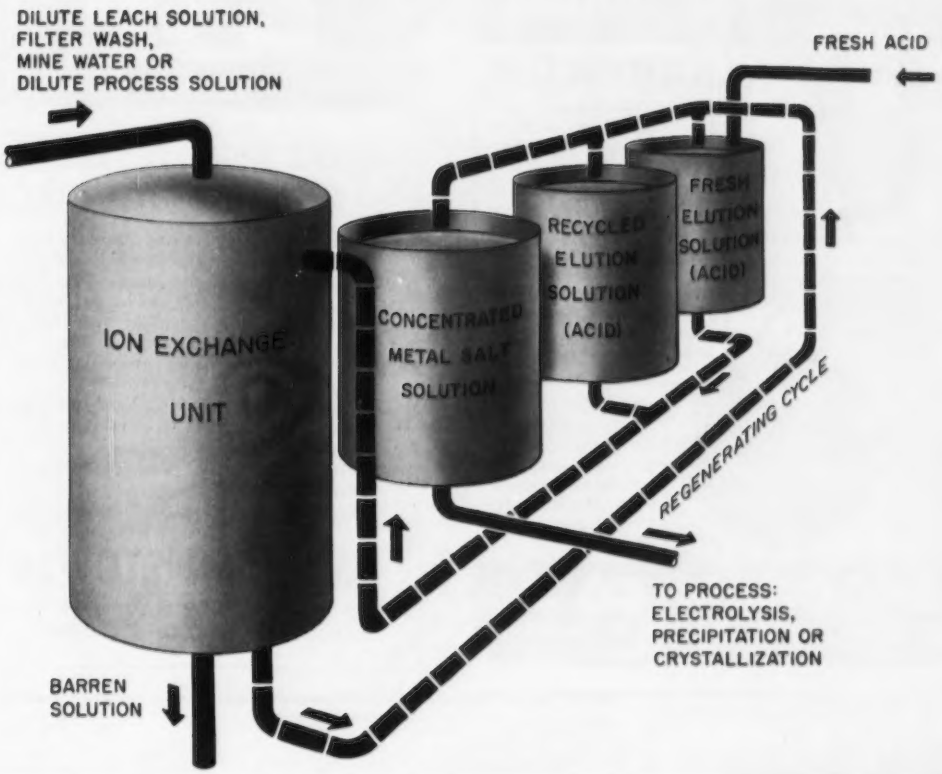

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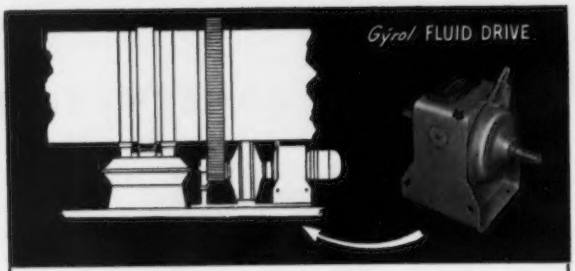

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(Continued on opposite page)

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1—6'—5 disc Morse Leaf Filter
1—18" Morse Filter Press
1—36" Sweetland #12 Filter Press

CRUSHERS
4—4¼" x 3½" New Morse Lab Jaw Crushers
4—4" x 6" New Morse Lab Jaw Crushers
1—8" x 15" Wesling Jaw Crusher
1—9" x 24" Cedar Rapids Jaw Crusher
1—20" x 36" Austin-Western Jaw Crusher

PULVERIZERS
6—8" New Morse Lab. Pulverizers

HOISTS
1—10 HP Vulcan #0 Single Drum
1—15 HP H & B Single Drum
1—20 HP Vulcan Single Drum
1—22 HP Vulcan Double Drum
3—25 HP Vulcan Single Drum
1—30 HP Vulcan Single Drum
1—37 HP Single Drum
1—50 HP Fairbanks-Morse Single Drum
1—75 HP Vulcan Single Drum
2—75 HP Vulcan Double Drum
3—100 HP Box Single Drum
2—112 HP Vulcan Single Drum
3—125 HP Ottumwa Single Drum
1—150 HP Vulcan Single Drum
1—250 HP Ottumwa Single Drum

SLUSHER HOISTS
4—5 HP Sullivan Double Drum Slusher Model HDE
1—Joy 15 HP Double Drum Slusher Model AF-212
2—20 HP Ingersoll-Rand Model 20 NM Double Drum Slushers
1—50 HP Sullivan Double Drum Slusher Model CF-211
1—Joy 10 HP 3 drum Slusher.
1—Sullivan 2 Drum Slusher Model HD-10-B, Gas Engine Driven

AIR TUGGER HOISTS
1—Ingersoll-Rand Model D8U
5—Gardner-Denver Model HK
1—Sullivan Model L111
2—Joy Model F113
1—Gardner-Denver Model HM
1—Ingersoll-Rand Model HU

ELECTRIC TUGGER HOISTS
1—5 HP Brownie Model HG
1—5HP Sullivan Model DE
2—7½ HP Sullivan Model HE

BALL AND ROD MILLS
1—4' x 4' Marcy Ball Mill
1—5' x 48" Hardinge Conical Ball Mill
1—8' x 22" Hardinge Conical Pebble Mill

CLASSIFIERS
1—27" x 14'8" Denver Simplex Rake Classifier
1—45" x 17'3" Akins Spiral Simplex Classifier

FLOTATION MACHINES
1—Fagergren Single Cell Type SDT
1—Morse Jet-Air New Hydracell #7
1—4 cell Denver "Sub-A" #12
1—4 cell Denver "Sub-A" #15
1—6 cell Denver "Sub-A" #18

CENTRICLONE
1—Centriclone, size C-10, Equipment Engineers with 10 HP motor, mounted in structural steel frame with 2" Wilfley rubber lined sand pump and 7½ HP motor

MUCKING MACHINES
2—12B Eimco Loaders
4—21 Eimco Loaders

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29—16 Cu. Ft. Ore Cars, Swivel End Dump
3—26 Cu. Ft. Card Granby Type Cars
3—27 Cu. Ft. Koppel Rocker Dump Cars
6—54 Cu. Ft. Koppel Rocker Dump Cars
12—84 Cu. Ft. Truax Rocker Dump Cars

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1—30 KW Buda-Century
1—50 KW Cummins-General Electric
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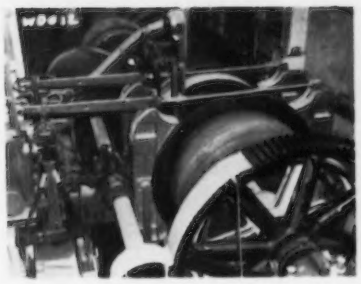

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3—4-ton Mancha 24" ga. complete.
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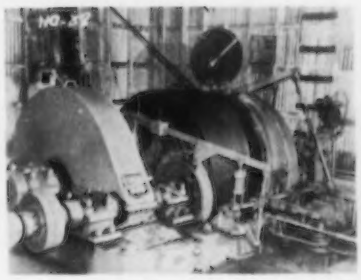

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1—6-cell Denver #30, 15 HP
3—5-cell 66" Fagergren
5—4-cell 56" Fagergren
2—8-cell 56" Fagergren
8—48" Agitair, 2-cell unit
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2—26"x26" Pan American Duplex.
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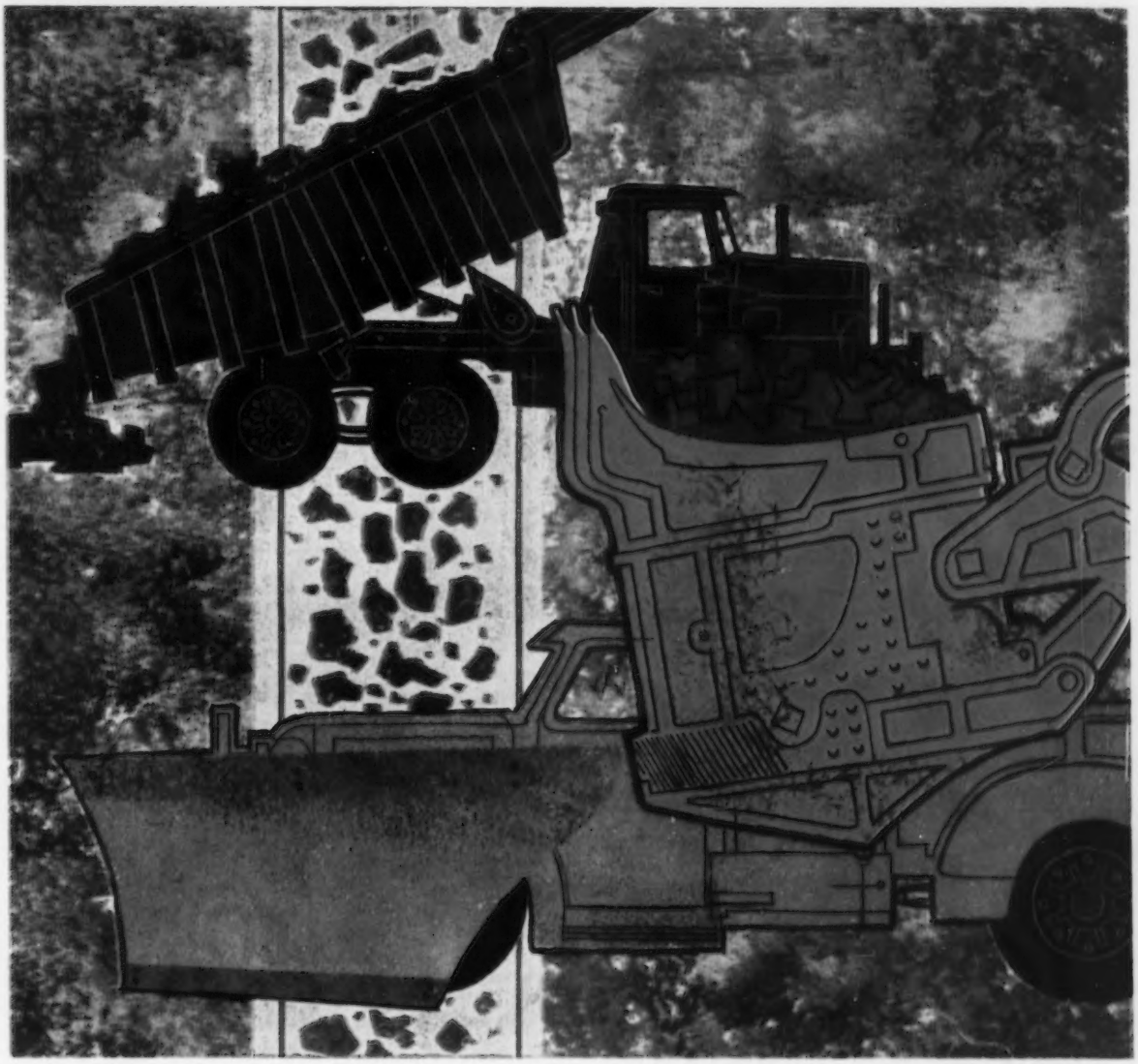

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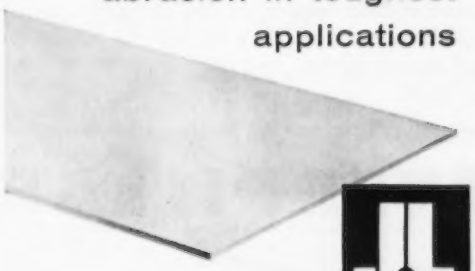

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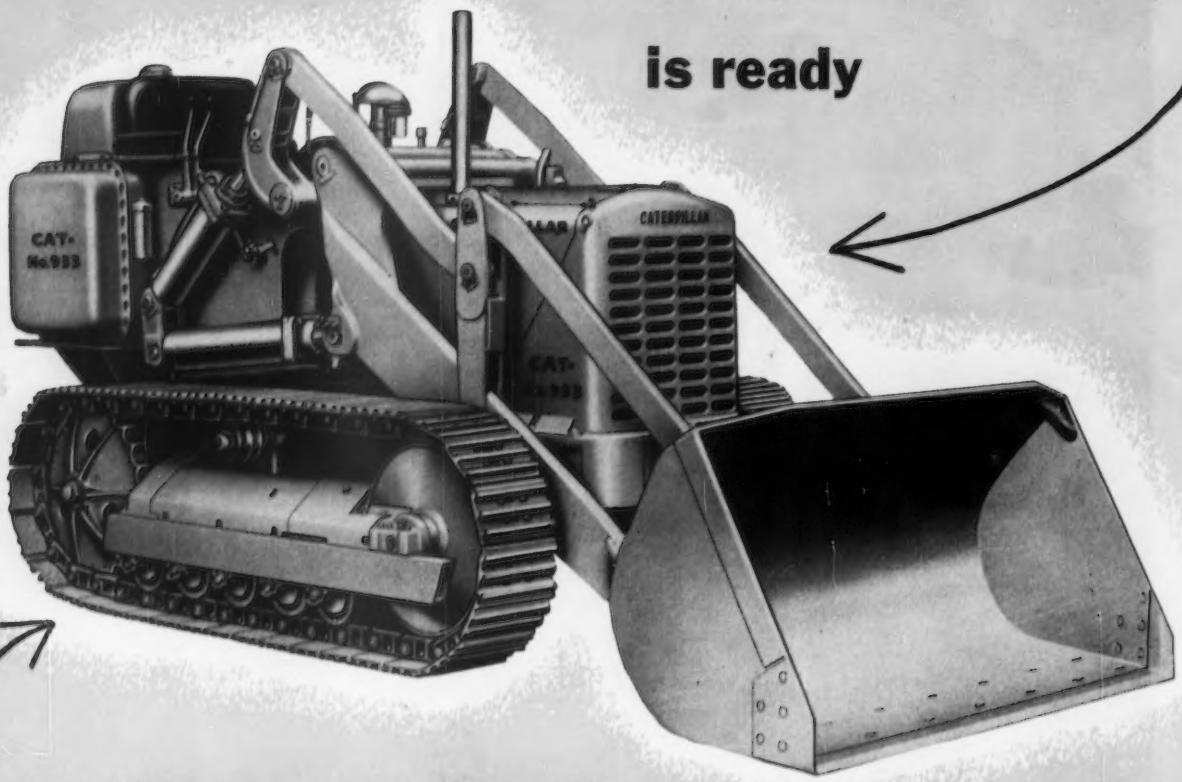

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- New Heavier Idlers
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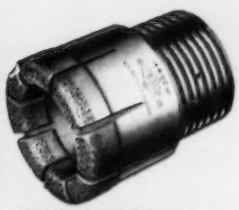

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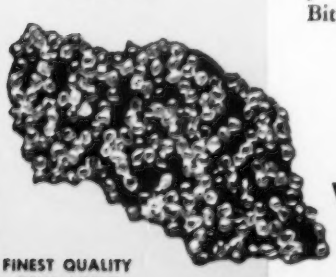
TRUCO REAMING SHELLS

TRUCO STANDARD OIL FIELD BIT



FINEST QUALITY DRILL BORTZ

Cost per foot drilled DOWN 40%

Footage per hour UP 42.8%

Footage per bit UP 35.3%

On a dam-building job in the northwest, Truco standard non-coring bits were being used in grouting work in a hard abrasive rock formation.

Although progress was normal for this type of formation, our field engineers felt that it might be improved and set up studies of field conditions and analysis of used bits to find out whether bit performance might be bettered and if so, by what methods.

First conclusions were that more circulating fluid was required and severe abrasion around the water ways (due to the hard nature of the rock) must be overcome.

To relieve these conditions, Truco Special Cross Plug Bit No. 1 was designed and showed an appreciable improvement in performance.

However, further study showed pressure building up in the center of the bit and Truco Special Cross Plug Bit No. 2 was designed and demonstrated the substantial and continuous improvement and economies tabulated below.

The development of this bit and the resulting economies are typical of similar opportunities in many drilling operations and indicate the advantage of working with *one* organization and giving it full responsibility in developing a bit tailor-made to the job.

To the driller, the potential gain can be substantial and—money saved on drilling costs is clear profit.

If drilling costs are *your* responsibility, maybe you should talk to the Truco Diamond Drill Bit man. Very likely he can help you.

	Cost Per Foot Drilled	Footage Per Hour	Footage Per Bit
Standard bits	.72	7′	33.3′
Special Truco Cross Plug Bits	.431	10′	45′
	DOWN 40%	UP 42.8%	UP 35.3%

TRUCO DIAMOND BITS

by

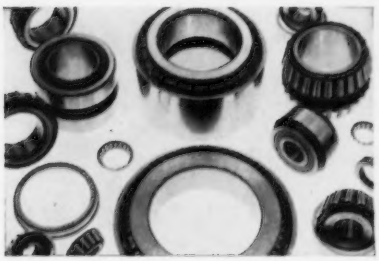
WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

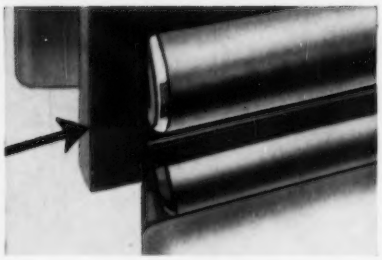
WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

DRILL BORTZ

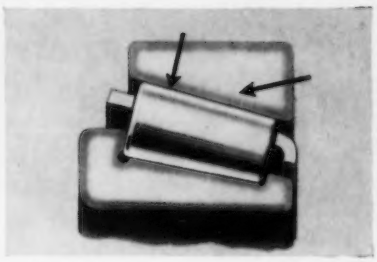
Get all these advantages . . . specify TIMKEN® tapered roller bearings



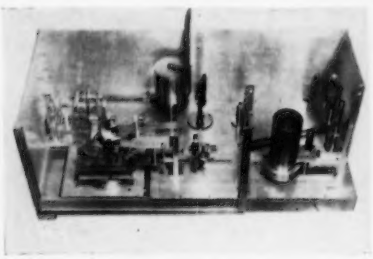
THERE ARE 27 TYPES of Timken® tapered roller bearings. This wide selection means you get the bearing design exactly suited to your job. Whatever your bearing application problem, we can help solve it.



THE SOFT STEEL CAGE used in Timken tapered roller bearings separates the rollers, keeping them spaced evenly. This prevents scuffing of the rollers, adds to the bearing life and gives you more for your money.

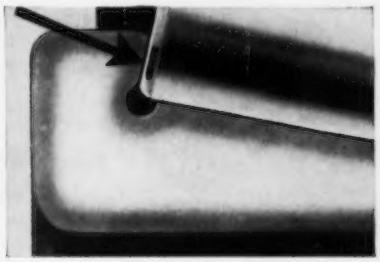


HARD ON THE OUTSIDE, tough on the inside. To take shock loads, give longer life, Timken bearing rollers and races are case-carburized to have a hard, wear-resistant surface over a tough, shock-resistant core.

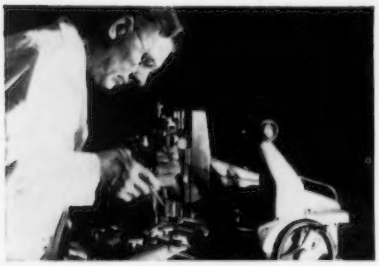


MICRO-INCH FINISH is standard for Timken bearings. This profilograph checks contours and smoothness of circular surfaces to a millionth of an inch, helps us make Timken bearings truer, quieter, longer-wearing.

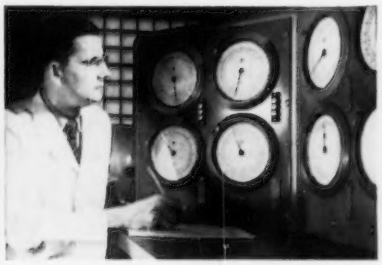
6,525 SIZES, the world's largest selection of tapered roller bearings. From bearings smaller than your finger to 71½" in inside diameter, the Timken Company can supply the size you need for any specific application.



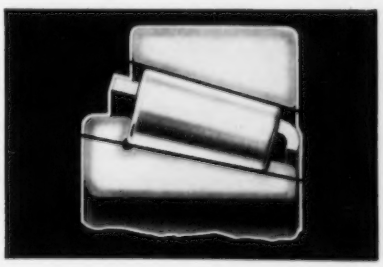
POSITIVE ROLLER ALIGNMENT is assured because the taper in Timken bearings holds ends of rollers snug against the rib. The taper in Timken bearings lets them take radial or thrust loads or any combination.



ACCURATE TO 50 MILLIONTHS of an inch. This Universal Measuring Machine checks gages and machine parts used to make Timken bearings. Our gage laboratory, one of the world's best equipped, helps make Timken tapered roller bearings your No. 1 bearing value.



WE MAKE OUR OWN FINE ALLOY STEEL. No other American bearing maker does. This spectrometer helps control steel quality—in 40 seconds gives the exact chemical analysis of a melt. In a few minutes, results are flashed to the melter. It's another step in rigid quality control.



FULL LINE OF CONTACT between Timken bearings' rollers and races gives them *extra* load-carrying capacity. To get *all* these advantages, specify "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN *TAPERED ROLLER BEARINGS ROLL THE LOAD*

TRADE-MARK REG. U. S. PAT. OFF.